

R309-215. Monitoring and Water Quality: Treatment Plant Monitoring Requirements.

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R309-215. Monitoring and Water Quality: Treatment Plant Monitoring Requirements.

R309-215-1. Purpose.

The purpose of this rule is to outline the monitoring and reporting requirements for public water systems which treat water prior to providing it for human consumption.

R309-215-2. Authority.

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104 of the Utah Code and in accordance with 63-46a of the same, known as the Administrative Rulemaking Act.

R309-215-3. Definitions.

Definitions for certain terms used in this rule are given in R309-110 but may be further clarified herein.

R309-215-4. General.

- (1) All public water systems are required to monitor their water to determine if they comply with the requirements for water quality stated in R309-200. In exceptional circumstances the Executive Secretary may modify the monitoring requirements given herein as is deemed appropriate.
- (2) The Executive Secretary may determine compliance or initiate compliance actions based upon analytical results and other information compiled by authorized representatives.
- (3) If the water fails to meet minimum standards, then certain public notification procedures shall be carried out, as outlined in R309-220. Water suppliers shall also keep analytical records in their possession, for a required length of time, as outlined in R309-105-17.
- (4) All samples shall be taken at representative sites as specified herein for each contaminant or group of contaminants.
- (5) For the purpose of determining compliance, samples may only be considered if they have been analyzed by the State of Utah primacy laboratory or a laboratory certified by the Utah State Health Laboratory.

(6) Measurements for pH, temperature, turbidity and disinfectant residual may, under the direction of the direct responsible operator, be performed by any water supplier or their representative.

(7) All samples shall be marked either: routine, repeat, check or investigative before submission of such samples to a certified laboratory. Routine, repeat, and check samples shall be considered compliance purpose samples.

(8) All sample results can be sent to the Division of Drinking Water either electronically or in hard copy form.

(9) Unless otherwise required by the Board, the effective dates on which required monitoring shall be initiated are identical to the dates published in 40 CFR 141 on July 1, 2001 by the Office of the Federal Register

(10) Exemptions from monitoring requirements shall only be granted in accordance with R309-105-5.

R309-215-5. Monitoring Requirements for Groundwater Disinfection.

(1) General: Continuous disinfection is recommended for all drinking water sources. Continuous disinfection shall be required of all groundwater sources which do not consistently meet standards of bacteriologic quality. Once required by the Executive Secretary continuous disinfection shall not be interrupted nor terminated unless so authorized, in writing, by the Executive Secretary.

(2) Disinfection Reporting: For each disinfection treatment facility, plant management shall report information to the Division as specified in R309-105-16(2)(c).

(3) A water system shall report a malfunction of any facility or equipment such that a detectable residual cannot be maintained throughout the distribution system. The system shall notify the Division as soon as possible, but no later than by the end of the next business day. The system also shall notify the Division by the end of the next business day whether or not the residual was restored to at least 0.2 mg/L within four hours.

R309-215-6. Monitoring Requirements for Miscellaneous Treatment Plants.

(1) Treatment of the drinking water may be required for other than inactivation of microbial contaminants or removal/inactivation of pathogens and viruses. Miscellaneous treatment methods are outlined in R309-535.

(2) The Executive Secretary may require additional monitoring as necessary to evaluate the treatment process and to ensure the quality of the water. The specific analytes, frequency of monitoring, the reporting frequency and the sampling location for which monitoring may be required shall be determined by the following:

- (a) the contaminant of concern for which the treatment process has been installed;
- (b) the process control samples required to operate treatment process being used; and
- (c) alternative surrogate sampling when it is either quicker or less expensive and still provides the necessary information;

(3) For point-of-use or point-of-entry technology the location of sampling may be at each treatment unit spread out over time.

(4) If monitoring is required, the Executive Secretary shall provide the report forms and the water system shall report the data as required by R309-105-16(3). Alternate forms may be used as long as prior approval from the Executive Secretary is obtained.

R309-215-7. Surface Water Treatment Evaluations.

(1) General: Surface water sources or groundwater sources under direct influence of surface water shall be disinfected during the course of required surface water treatment. Disinfection shall not be considered a substitute for inadequate collection facilities. All public water systems which use a treatment technique to treat water obtained in whole or in part from surface water sources or ground water sources under the direct influence of surface water shall monitor the plant's operation and report the results to the Division as indicated in R309-215-7 through R309-215-14. Individual plants will be evaluated in accordance with the criteria outlined in paragraph (2) below. Based on information submitted and/or plant inspections, the plant will receive credit for treatment techniques other than disinfection that remove pathogens, specifically *Giardia lamblia* and viruses. This credit (log removal) will reduce the required disinfectant "CT" value which the plant shall maintain to assure compliance with R309-200-5(7)(a)(i).

(2) Criteria for Individual Treatment Plant Evaluation: New and existing water treatment plants shall meet specified monitoring and performance criteria in order to ensure that filtration and disinfection are satisfactorily practiced. The monitoring requirements and performance criteria for turbidity and disinfection listed above provide the minimum for the Division to evaluate the plant's efficiency in removing and/or inactivating 99.9 percent (3-log) of *Giardia lamblia* cysts and 99.99 percent (4-log) of viruses as required by R309-505-6(2)(a) and (b).

(3) The Division, upon evaluation of individual raw water sources, surface water or ground water under the direct influence of surface water, may require greater than the 3-log, 4-log removal/inactivation of Giardia and viruses respectfully. If a raw water source exhibits an estimated concentration of 1 to 10 Giardia cysts per 100 liters, 4 and 5-log removal/inactivation may be required. If the raw water exhibits a concentration of 10 to 100 cysts per 100 liters, 5 and 6-log removal/inactivation may be required.

If a plant decides to recycle any spent filter backwash water, thickener supernatant, or liquids from dewatering processes the Division shall be notified in writing by December 8, 2003 or prior to recycling such waters. Such notification shall include, at a minimum:

- (a) A plant schematic showing the origin of all flows which are recycled (including, but not limited to, spent filter backwash water, thickener supernatant, and any liquids from dewatering processes), the hydraulic conveyance used to transport them, and the location where they are reintroduced back into the treatment plant.
- (b) Typical recycle flow in gallons per minute (gpm), the highest observed plant flow experienced in the previous year (gpm), design flow for the treatment plant (gpm), and Division approved operating capacity for the plant where the Division has made such determinations.
- (c) Treatment technique (TT) requirement. Any system that recycles spent filter backwash water, thickener supernatant, or liquids from dewatering processes shall return these flows through the processes of a system's existing conventional or direct filtration system as defined in R309-525 or R309-530 or at an alternate location approved by the Division by or after June 8, 2004. If capital improvements are required to modify the recycle location to meet this requirement, all capital improvements must be completed no later than June 8, 2006.

(4) The Division, upon individual plant evaluation, may assign the treatment techniques (coagulation, flocculation, sedimentation and filtration) credit toward removal of Giardia cysts and viruses. The greater the number of barriers in the treatment process, the greater the reduction of pathogens, therefore lessor credit will be given to processes such as direct filtration which eliminate one or more conventional barriers. Plants may monitor turbidity at multiple points in the treatment process as evidence of the performance of an individual treatment technique.

(5) The nominal credit that will be assigned certain conventional processes are outlined in Table 215-1:

TABLE 215-1 CONVENTIONAL PROCESS CREDIT		
Process	Log Reduction Credit	
	Giardia	Viruses

Conventional Complete Treatment	2.5	2.0
Direct Filtration	2.0	1.0
Slow Sand Filtration	2.0	2.0
Diatomaceous Earth	2.0	1.0

(6) Upon evaluation of information provided by individual plants or obtained during inspections by Division staff, the Division may increase or decrease the nominal credit assigned individual plants based on that evaluation.

(a) Items which would augment the treatment process and thereby warrant increased credit are:

- (i) facilities or means to moderate extreme fluctuations in raw water characteristics;
- (ii) sufficient on-site laboratory facilities regularly used to alert operators to changes in raw water quality;
- (iii) use of pilot stream facilities which duplicate treatment conditions but allow operators to know results of adjustments much sooner than if only monitoring plant effluent;
- (iv) use of additional monitoring methods such as particle size and distribution analysis to achieve greater efficiency in particulate removal;
- (v) regular program for preventive maintenance, records of such, and general good housekeeping; or
- (vi) adequate staff of well trained and certified plant operators.

(b) Items which would be considered a detriment to the treatment process and thereby warrant decreased credit are:

- (i) inadequate staff of trained and certified operators;
- (ii) lack of regular maintenance and poor housekeeping; or
- (iii) insufficient on-site laboratory facilities.

R309-215-8. Surface Water Treatment Plant Monitoring and Reporting.

Treatment plant management shall report the following to the Division within ten days after the end of each month that the system serves water to the public, except as otherwise noted:

R309-215. Monitoring and Water Quality: Treatment Plant Monitoring Requirements.

(1) For each day;

- (a) if the plant treats water from multiple sources, the sources being utilized (including recycled backwash water) and the ratio for each if blending occurs.
- (b) the total volume of water treated by the plant,
- (c) the turbidity of the raw water entering the plant,
- (d) the pH of the effluent water, measured at or near the monitoring point for disinfectant residual,
- (e) the temperature of the effluent water, measured at or near the monitoring point for disinfectant residual,
- (f) the type and amount of chemicals used in the treatment process (clearly indicating the weight and active percent of chemical if dry feeders are used, or the percent solution and volume fed if liquid feeders are used),
- (g) the high and low temperature and weather conditions (local forecast information may be used, but any precipitation in the watershed should be further described as light, moderate, heavy, or extremely heavy), and
- (h) the results of any "jar tests" conducted that day

(2) For each filter, each day;

- (a) the rate of water applied to each (gpm/sq.ft.),
- (b) the head loss across each (feet of water or psi),
- (c) length of backwash (if conducted; in minutes), and
- (d) hours of operation since last backwashed.

(3) Annually;

certify in writing as required by R309-105-14(1) that when a product containing acrylamide and/or epichlorohydrin is used, the combination of the amount of residual monomer in the polymer and the dosage rate does not exceed the levels specified as follows:

- (a) Acrylamide: 0.05%, when dosed at 1 part per million, and
- (b) Epichlorohydrin: 0.01%, when dosed at 20 parts per million.

Certification may rely on manufacturers data.

(4) Additional record-keeping for plants that recycle.

The system must collect and retain on file recycle flow information for review and evaluation by the Division beginning June 8, 2004 or upon approval for recycling. As a minimum the following shall be maintained:

- (a) Copy of the recycle notification and information submitted to the Division under R309-215-7(3).
- (b) List of all recycle flows and the frequency with which they are returned.
- (c) Average and maximum backwash flow rates through the filters and the average and maximum duration of the filter backwash process in minutes.
- (d) Typical filter run length and a written summary of how filter run length is determined.
- (e) The type of treatment provided for the recycle flow.
- (f) Data on the physical dimensions of the equalization and/or treatment units, typical and maximum hydraulic loading rates, type of treatment chemicals used, average dose, frequency of use and frequency at which solids are removed, if applicable.

R309-215-9. Turbidity Monitoring and Reporting.

Public water systems utilizing surface water and ground water under the direct influence of surface water shall monitor for turbidity in accordance with this section. Small surface water systems serving a population less than 10,000 shall monitor in accordance with subsections (1), (2), (3), (5) and (6). Large surface water systems serving 10,000 or more population shall monitor in accordance with subsections (1), (2), (3), (4) and (6).

(1) Routine Monitoring Requirements for Treatment Facilities utilizing surface water sources or ground water sources under the direct influence of surface water.

- (a) All public water systems which use a treatment technique to treat water obtained in whole or in part from surface water sources or ground water sources under the direct influence of surface water shall monitor for turbidity at the

treatment plant's clearwell outlet. This monitoring shall be independent of the individual filter monitoring required by R309-525-15(4)(b)(vi) and R309-525-15(4)(c)(vii). Where the plant facility does not have an internal clearwell, the turbidity shall be monitored at the inlet to a finished water reservoir external to the plant provided such reservoir receives only water from the treatment plant and, furthermore, is located before any point of consumer connection to the water system. If such external reservoir does not exist, turbidity shall then be monitored at a location immediately downstream of the treatment plant filters.

(b) All treatment plants, with the exception of those utilizing slow sand filtration and other conditions indicated in section (c) below, shall be equipped with continuous turbidity monitoring and recording equipment for which the direct responsible charge operator will validate the continuous measurements for accuracy in accordance with paragraph (d) below. These plants shall continuously record the finished water turbidity of the combined filter effluent as well as each individual filter. All systems shall be equipped to continuously monitor the turbidity at each filter unless the treatment plant is only equipped with two filters and the turbidity is measured at the combined filter effluent (CFE). If there is a failure in continuous monitoring equipment the system shall conduct grab sampling every 4 hours in lieu of continuous monitoring, but for no more than five working days following the failure of equipment. Systems serving less than 10,000 population shall have no more than 14 days to conduct grab samples in lieu of continuous monitoring in order to correct any failing equipment. All surface water systems shall monitor the turbidity results of individual filters at a frequency no greater than every 15 minutes.

(c) Turbidity measurements, as outlined below, shall be reported to the Division within ten days after the end of each month that the system serves water to the public. Systems are required to mark and interpret turbidity values from the recorded charts at the end of each four-hour interval of operation (or some shorter regular time interval) to determine compliance with the turbidity performance criterion. For systems using slow sand filtration the Executive Secretary may reduce the sampling frequency to as little as once per day if the Executive Secretary determines that less frequent monitoring is sufficient to indicate effective filtration performance. For systems serving 500 or fewer persons, the Executive Secretary may reduce the turbidity sampling frequency to as little as once per day, regardless of the type of filtration treatment used, if the Executive Secretary determines that less frequent monitoring is sufficient to indicate effective filtration performance.

The following shall be reported and the required percentage achieved for compliance:

- (i) The total number of interpreted filtered water turbidity measurements taken during the month;

(ii) The number and percentage of interpreted filtered water turbidity measurements taken during the month which are less than or equal to the turbidity limits specified in R309-200-5(5)(a)(ii) (or increased limit approved by the Executive Secretary). The percentage of measurements which are less than or equal to the turbidity limit shall be 95 percent or greater for compliance; and

(iii) The date and value of any turbidity measurements taken during the month which exceed 5 NTU. The system shall inform the Division as soon as practical, but no later than 24 hours after the exceedance is known, in accordance with R309-220-6(2)(c) if any turbidity measurements exceed 5 NTU.

(d) The analytical method which shall be followed in making the required determinations shall be Nephelometric Method - Nephelometric Turbidity Unit as set forth in the latest edition of Standard Methods for Examination of Water and Wastewater, 1985, American Public Health Association et al., (Method 214A, pp. 134-136 in the 16th edition). Continuous turbidity monitoring equipment shall be checked for accuracy and recalibrated using methods outlined in the above standard at a minimum frequency of monthly. The direct responsible charge operator will note on the turbidity report form when these recalibrations are conducted. For systems that practice lime softening, the representative combined filter effluent turbidity sample may be acidified prior to analysis with prior approval by the Executive Secretary as to the protocol.

(2) Procedures if a Filtered Water Turbidity Limit is Exceeded

(a) Resampling -

If an analysis indicates that the turbidity limit has been exceeded, the sampling and measurement shall be confirmed by resampling as soon as practicable and preferably within one hour.

(b) If the result of resampling confirms that the turbidity limit has been exceeded, the system shall collect and have analyzed at least one bacteriologic sample near the first service connection from the source as specified in R309-210-5(1)(f). The system shall collect this bacteriologic sample within 24 hours of the turbidity exceedance. Sample results from this monitoring shall be included in determining bacteriologic compliance for that month.

(c) Initial Notification of the Executive Secretary -

If the repeat sample confirms that the turbidity limit has been exceeded, the supplier shall report this fact to the Executive Secretary as soon as practical, but no later than 24 hours after the exceedance is known in accordance with the

public notification requirements under R309-220-6(2)(c). This reporting is in addition to reporting the incident on any monthly reports.

(3) For the purpose of individual plant evaluation and establishment of pathogen removal credit for the purpose of lowering the required "CT" value assigned a plant, plant management may do additional turbidity monitoring at other points to satisfy criteria in R309-215-7(2).

(4) Additional reporting and recordkeeping requirements for large surface water systems (serving greater than 10,000 population) reporting and recordkeeping requirements.

In addition to the reporting and recordkeeping requirements sub-sections (1), (2) and (3) above, a large surface water system that provides conventional filtration treatment or direct filtration shall report monthly to the Division the information specified in paragraphs (a) and (b) of this section. In addition to the reporting and recordkeeping requirements above, a public water system subject to the requirements of this subpart that provides filtration approved under R309-530-8 or R309-530-9 shall report monthly to the Division the information specified in paragraphs (a) of this section. The reporting in paragraph (a) of this section is in lieu of the reporting specified above.

(a) Turbidity measurements, as required in R309-200-5(5)(a), shall be reported within 10 days after the end of each month the system serves water to the public. Information that shall be reported includes:

(i) The total number of filtered water turbidity measurements taken during the month.

(ii) The number and percentage of filtered water turbidity measurements taken during the month which are less than or equal to 0.3 NTU or those levels established under R309-200-5(5)(a)(ii).

(iii) The date and value of any turbidity measurements taken during the month which exceed 1 NTU for systems using conventional filtration treatment or direct filtration, or which exceed the maximum level set by the Executive Secretary under R309-530-8 or R309-530-9.

(b) Systems shall maintain the results of individual filter monitoring taken under R309-215-9(1)(b) for at least three years. Systems shall record the results of individual filter monitoring every 15 minutes. Systems shall report that they have conducted individual filter turbidity monitoring within 10 days after the end of each month the system serves water to the public. Systems shall report individual filter turbidity measurement results within 10 days after the end of each month the system serves water to the public only if measurements demonstrate one or more of the conditions in paragraphs (b)(i) through (iv) of this section. Systems that use lime softening may apply to the Executive Secretary for alternative exceedance levels for the levels specified in paragraphs (b)(i) through (iv) of this

section if they can demonstrate that higher turbidity levels in individual filters are due to lime carryover only and not due to degraded filter performance.

(i) For any individual filter that has a measured turbidity level of greater than 1.0 NTU in two consecutive measurements taken 15 minutes apart, the system shall report the filter number, the turbidity measurement, and the date(s) on which the exceedance occurred. In addition, the system shall either produce a filter profile for the filter within 7 days of the exceedance (if the system is not able to identify an obvious reason for the abnormal filter performance) and report that the profile has been produced or report the obvious reason for the exceedance.

(ii) For any individual filter that has a measured turbidity level of greater than 0.5 NTU in two consecutive measurements taken 15 minutes apart at the end of the first four hours of continuous filter operation after the filter has been backwashed or otherwise taken offline, the system shall report the filter number, the turbidity, and the date(s) on which the exceedance occurred. In addition, the system shall either produce a filter profile for the filter within 7 days of the exceedance (if the system is not able to identify an obvious reason for the abnormal filter performance) and report that the profile has been produced or report the obvious reason for the exceedance.

(iii) For any individual filter that has a measured turbidity level of greater than 1.0 NTU in two consecutive measurements taken 15 minutes apart at any time in each of three consecutive months, the system shall report the filter number, the turbidity measurement, and the date(s) on which the exceedance occurred. In addition, the system shall conduct a self-assessment of the filter within 14 days of the exceedance and report that the self-assessment was conducted. The self assessment shall consist of at least the following components: assessment of filter performance; development of a filter profile; identification and prioritization of factors limiting filter performance; assessment of the applicability of corrections; and preparation of a filter self-assessment report.

(iv) For any individual filter that has a measured turbidity level of greater than 2.0 NTU in two consecutive measurements taken 15 minutes apart at any time in each of two consecutive months, the system shall report the filter number, the turbidity measurement, and the date(s) on which the exceedance occurred. In addition, the system shall arrange for and conduct a comprehensive performance evaluation by the Division or a third party approved by the Executive Secretary no later than 30 days following the exceedance and have the evaluation completed and submitted to the Division no later than 90 days following the exceedance.

(5) Additional reporting and recordkeeping requirements for surface water systems serving less than 10,000 population.

In addition to the reporting and recordkeeping requirements sub-sections (1), (2) and (3) above, a surface water system that provides conventional filtration treatment or direct filtration shall report monthly to the Division the information specified in paragraphs (a) and (b) of this section. In addition to the reporting and recordkeeping requirements above, a public water system subject to the requirements of this subpart that provides filtration approved under R309-530-8 or R309-530-9 shall report monthly to the Division the information specified in paragraphs (a) of this section. The reporting in paragraph (a) of this section is in lieu of the reporting specified above.

(a) Turbidity measurements, as required in R309-200-5(5)(a), shall be reported within 10 days after the end of each month the system serves water to the public. Information that shall be reported includes:

(i) The total number of filtered water turbidity measurements taken during the month.

(ii) The number and percentage of filtered water turbidity measurements taken during the month which are less than or equal to 0.3 NTU or those levels established under R309-200-5(5)(a)(ii).

(iii) The date and value of any turbidity measurements taken during the month which exceed 1 NTU for systems using conventional filtration treatment or direct filtration, or which exceed the maximum level set by the Executive Secretary under R309-530-8 or R309-530-9.

(b) Systems shall maintain the results of individual filter monitoring taken under R309-215-9(1)(b) for at least three years. Systems shall record the results of individual filter monitoring every 15 minutes. Systems shall report that they have conducted individual filter turbidity monitoring within 10 days after the end of each month the system serves water to the public. Systems shall report individual filter turbidity measurement results within 10 days after the end of each month the system serves water to the public only if measurements demonstrate one or more of the conditions in paragraphs (b)(i) through (iv) of this section. Systems that use lime softening may apply to the Executive Secretary for alternative exceedance levels for the levels specified in paragraphs (b)(i) through (iv) of this section if they can demonstrate that higher turbidity levels in individual filters are due to lime carryover only and not due to degraded filter performance.

(i) For any individual filter (or CFE for systems with 2 filters that monitor CFE in lieu of individual filters) that has a measured turbidity level of greater than 1.0 NTU in two consecutive measurements taken 15 minutes apart, the system shall report the filter number(s), the corresponding date(s), the turbidity values which exceeded 1.0 NTU, and the cause (if

known) for the exceedance(s), to the Executive Secretary by the 10th of the following month.

(ii) If a system was required to report to the Executive Secretary for three months in a row and turbidity exceeded 1.0 NTU in two consecutive recordings taken 15 minutes apart at the same filter (or CFE for systems with 2 filters that monitor CFE in lieu of individual filters), the system shall conduct a self-assessment of the filter within 14 days of the day the filter exceeded 1.0 NTU in two consecutive measurements for the third straight month unless a CPE as specified in paragraph (iii) of this section was required. Systems with 2 filters that monitor CFE in lieu of individual filters must conduct a self assessment on both filters. The self-assessment must consist of at least the following components: assessment of filter performance; development of a filter profile; identification and prioritization of factors limiting filter performance; assessment of the applicability of corrections; and preparation of a filter self-assessment report. If a self-assessment is required, the date that it was triggered and the date that it was completed.

(iii) If a system was required to report to the Executive Secretary for two months in a row and turbidity exceeded 2.0 NTU in two consecutive measurements taken 15 minutes apart at the same filter (or CFE for systems with 2 filters that monitor CFE in lieu of individual filters), the system shall arrange to have a comprehensive performance evaluation (CPE) conducted by the Division or a third party approved by the Executive Secretary no later than 60 days following the day the filter exceeded 2.0 NTU in two consecutive measurements for the second straight month. If a CPE is required, the system must report a CPE required and the date it was triggered. If a CPE has been completed by the Division or a third party approved by the Executive Secretary within the 12 prior months or the system and Division are jointly participating in an ongoing Comprehensive Technical Assistance (CTA) project at the system, a new CPE is not required. If conducted, a CPE must be completed and submitted to the Division no later than 120 days following the day the filter exceeded 2.0 NTU in two consecutive measurements for the second straight month.

(6) Additional reporting requirements.

(a) If at any time the turbidity exceeds 1 NTU in representative samples of filtered water in a system using conventional filtration treatment or direct filtration, the system shall inform the Division as soon as possible, but no later than the end of the next business day.

(b) If at any time the turbidity in representative samples of filtered water exceeds the maximum level set by the Executive Secretary under R309-530-8 or R309-

530-9 for filtration technologies other than conventional filtration treatment, direct filtration, slow sand filtration, or diatomaceous earth filtration, the system shall inform the Division as soon as possible, but no later than the end of the next business day.

R309-215-10. Residual Disinfectant.

Treatment plant management shall continuously monitor disinfectant residuals and report the following to the Division within ten days after the end of each month that the system serves water to the public, except as otherwise noted:

(1) For each day, the lowest measurement of residual disinfectant concentration in mg/L in water entering the distribution system, except that if there is a failure in the continuous monitoring equipment, grab sampling every 4 hours may be conducted in lieu of continuous monitoring, but for no more than 5 working days following the failure of the equipment. Systems serving 3,300 or fewer persons may take grab samples in lieu of providing continuous monitoring on an ongoing basis at the frequencies listed in Table 215.2 below:

TABLE 215-2 RESIDUAL GRAB SAMPLE FREQUENCY	
System size by population	Samples/day
Less than 500	1
501 to 1,000	2
1,001 to 2,500	3
2,501 to 3,300	4
Note: The day's samples cannot be taken at the same time. The sampling intervals are subject to Executive Secretary's review and approval.	

(2) The date and duration of each period when the residual disinfectant concentration in water entering the distribution system fell below 0.2 mg/L and when the Division was notified of the occurrence. The system shall notify the Division as soon as possible, but no later than by the end of the next business day. The system also shall notify the Division by the end of the next business day whether or not the residual was restored to at least 0.2 mg/L within four hours.

(3) The following information on the samples taken in the distribution system in conjunction with total coliform monitoring pursuant to R309-210-5:

- (a) number of instances where the residual disinfectant concentration is measured;
- (b) number of instances where the residual disinfectant concentration is not measured but heterotrophic bacteria plate count (HPC) is measured;

(c) number of instances where the residual disinfectant concentration is measured but not detected and no HPC is measured;

(d) number of instances where no residual disinfectant concentration is detected and where HPC is greater than 500/ml;

(e) number of instances where the residual disinfectant concentration is not measured and HPC is greater than 500/ml;

(f) for the current and previous month the system serves water to the public, the value of "V" in the formula, $V = ((c+d+e)/(a+b)) \times 100$, where a = the value in sub-section (a) above, b = the value in sub-section (b) above, c = the value in sub-section (c) above, d = the value in sub-section (d) above, and e = the value in sub-section (e) above.

R309-215-11. Waterborne Disease Outbreak.

Each public water system, upon discovering that a waterborne disease outbreak as defined in R309-110 potentially attributable to their water system has occurred, shall report that occurrence to the Division as soon as possible, but no later than by the end of the next business day.

R309-215-12. Monitoring Requirements for Disinfection Byproducts Precursors (DBPP).

(1) Routine monitoring. Surface water systems which use conventional filtration treatment (as defined in R309-110) shall monitor each treatment plant for TOC no later than the point of combined filter effluent turbidity monitoring and representative of the treated water. All systems required to monitor under this paragraph (1) shall also monitor for TOC in the source water prior to any treatment at the same time as monitoring for TOC in the treated water. These samples (source water and treated water) are referred to as paired samples. At the same time as the source water sample is taken, all systems shall monitor for alkalinity in the source water prior to any treatment. Systems shall take one paired sample and one source water alkalinity sample per month per plant at a time representative of normal operating conditions and influent water quality.

(2) Reduced monitoring. Surface water systems with an average treated water TOC of less than 2.0 mg/L for two consecutive years, or less than 1.0 mg/L for one year, may reduce monitoring for both TOC and alkalinity to one paired sample and one source water alkalinity sample per plant per quarter. The system shall revert to routine monitoring in the month following the quarter when the annual average treated water TOC is greater than or equal to 2.0 mg/L.

(3) Compliance shall be determined as specified by R309-215-13(3). Systems may begin monitoring to determine whether Step 1 TOC removals can be met 12 months prior to the compliance date for the system. This monitoring is not required and failure to monitor during this period is not a violation. However, any system that does not monitor during this period, and then determines in the first 12 months after the compliance date that it is not able to meet the Step 1 requirements in R309-215-13(2)(b) and shall therefore apply for alternate minimum TOC removal (Step 2) requirements, is not eligible for retroactive approval of alternate minimum TOC removal (Step 2) requirements as allowed pursuant to R309-215-13(2)(c) and is in violation. Systems may apply for alternate minimum TOC removal (Step 2) requirements any time after the compliance date. For systems required to meet Step 1 TOC removals, if the value calculated under R309-215-13(3)(a)(iv) is less than 1.00, the system is in violation of the treatment technique requirements and shall notify the public pursuant to R309-220, in addition to reporting to the Executive Secretary pursuant to R309-105-16.

R309-215-13. Treatment Technique for Control of Disinfection Byproduct Precursors (DBPP).

(1) Applicability.

(a) Surface water systems using conventional filtration treatment (as defined in R309-110) shall operate with enhanced coagulation or enhanced softening to achieve the TOC percent removal levels specified in paragraph (2) of this section unless the system meets at least one of the alternative compliance criteria listed in paragraph (1)(b) or (1)(c) of this section.

(b) Alternative compliance criteria for enhanced coagulation and enhanced softening systems. Surface Water Systems using conventional filtration treatment may use the alternative compliance criteria in paragraphs (1)(b)(i) through (vi) of this section to comply with this section in lieu of complying with paragraph (2) of this section. Systems shall still comply with monitoring requirements in R309-215-12.

(i) The system's source water TOC level, measured according to R309-200-4(3), is less than 2.0 mg/L, calculated quarterly as a running annual average.

(ii) The system's treated water TOC level, measured according to R309-200-4(3), is less than 2.0 mg/L, calculated quarterly as a running annual average

(iii) The system's source water TOC level, measured according to R309-200-4(3), is less than 4.0 mg/L, calculated quarterly as a running annual average; the source water alkalinity, measured according to R309-200-

4(3), is greater than 60 mg/L (as CaCO₃), calculated quarterly as a running annual average; and either the TTHM and HAA5 running annual averages are no greater than 0.040 mg/L and 0.030 mg/L, respectively; or prior to the effective date for compliance in R309-210-8(1)(a), the system has made a clear and irrevocable financial commitment not later than the effective date for compliance in R309-210-8(1)(a) to use of technologies that will limit the levels of TTHMs and HAA5 to no more than 0.040 mg/L and 0.030 mg/L, respectively. Systems shall submit evidence of a clear and irrevocable financial commitment, in addition to a schedule containing milestones and periodic progress reports for installation and operation of appropriate technologies, to the Executive Secretary for approval not later than the effective date for compliance in R309-210-8(1)(a). These technologies shall be installed and operating not later than June 30, 2005. Failure to install and operate these technologies by the date in the approved schedule will constitute a violation of National Primary Drinking Water Regulations.

(iv) The TTHM and HAA5 running annual averages are no greater than 0.040 mg/L and 0.030 mg/L, respectively, and the system uses only chlorine for primary disinfection and maintenance of a residual in the distribution system.

(v) The system's source water SUVA, prior to any treatment and measured monthly according to R309-200-4(3), is less than or equal to 2.0 L/mg-m, calculated quarterly as a running annual average.

(vi) The system's finished water SUVA, measured monthly according to R309-200-4(3), is less than or equal to 2.0 L/mg-m, calculated quarterly as a running annual average.

(c) Additional alternative compliance criteria for softening systems. Systems practicing enhanced softening that cannot achieve the TOC removals required by paragraph (2)(b) of this section may use the alternative compliance criteria in paragraphs (1)(c)(i) and (ii) of this section in lieu of complying with paragraph (2) of this section. Systems shall still comply with monitoring requirements in R309-210-8(4).

(i) Softening that results in lowering the treated water alkalinity to less than 60 mg/L (as CaCO₃), measured monthly according to R309-200-4(3) and calculated quarterly as a running annual average.

(ii) Softening that results in removing at least 10 mg/L of magnesium hardness (as CaCO₃), measured monthly according to R309-200-4(3) and calculated quarterly as an annual running average.

(2) Enhanced coagulation and enhanced softening performance requirements.

(a) Systems shall achieve the percent reduction of TOC specified in paragraph (2)(b) of this section between the source water and the combined filter effluent, unless the Executive Secretary approves a system's request for alternate minimum TOC removal (Step 2) requirements under paragraph (2)(c) of this section.

(b) Required Step 1 TOC reductions, indicated in the following table, are based upon specified source water parameters measured in accordance with R309-200-4(3). Systems practicing softening are required to meet the Step 1 TOC reductions in the far-right column (Source water alkalinity >120 mg/L) for the specified source water TOC:

TABLE 215-3 Step 1 Required Removal of TOC by Enhanced Coagulation and Enhanced Softening for Surface Water Systems Using Conventional Treatment (See Notes 1,2)			
Source-Water TOC, mg/l	Source-Water Alkalinity, mg/L as CaCO ₃		
	0 – 60	>60 – 120	>120 (Note 3)
>2.0-4.0	35.0%	25.0%	15.0%
>4.0-8.0	45.0%	35.0%	25.0%
>8.0	50.0%	40.0%	30.0%
Note 1: Systems meeting at least one of the conditions in paragraph (1)(b)(i)-(vi) of this section are not required to operate with enhanced coagulation.			
Note 2: Softening systems meeting one of the alternative compliance criteria in paragraph (1)(c) of this section are not required to operate with enhanced softening.			
Note 3: Systems practicing softening shall meet the TOC removal requirements in this column.			

(c) Surface water systems using conventional treatment systems that cannot achieve the Step 1 TOC removals required by paragraph (2)(b) of this section due to water quality parameters or operational constraints shall apply to the Executive Secretary, within three months of failure to achieve the TOC removals required by paragraph (2)(b) of this section, for approval of alternative minimum TOC removal (Step 2) requirements submitted by the system. If the Executive Secretary approves the alternative minimum TOC removal (Step 2) requirements, the Executive Secretary may make those requirements retroactive for the purposes of determining compliance. Until the Executive Secretary approves the alternate minimum TOC removal (Step 2) requirements, the system shall meet the Step 1 TOC removals contained in paragraph (2)(b) of this section.

(d) Alternate minimum TOC removal (Step 2) requirements. Applications made to the Executive Secretary by enhanced coagulation systems for approval of alternate minimum TOC removal (Step 2) requirements under paragraph (2)(c) of this section shall include, at a minimum, results of bench- or pilot-scale testing conducted under paragraph (2)(d)(i) of this section. The submitted bench- or pilot- scale testing shall be used to determine the alternate enhanced coagulation level.

(i) Alternate enhanced coagulation level is defined as: Coagulation at a coagulant dose and pH as determined by the method described in paragraphs (2)(d)(i) through (v) of this section such that an incremental addition of 10 mg/L of alum (or equivalent amount of ferric salt) results in a TOC removal of less than or equal to 0.3 mg/L. The percent removal of TOC at this point on the "TOC removal versus coagulant dose" curve is then defined as the minimum TOC removal required for the system. Once approved by the Executive Secretary, this minimum requirement supersedes the minimum TOC removal required by the table in paragraph (2)(b) of this section. This requirement will be effective until such time as the Executive Secretary approves a new value based on the results of a new bench- and pilot-scale test. Failure to achieve Executive Secretary set alternative minimum TOC removal levels is a violation of R309-215-13.

(ii) Bench- or pilot-scale testing of enhanced coagulation shall be conducted by using representative water samples and adding 10 mg/L increments of alum (or equivalent amounts of ferric salt) until the pH is reduced to a level less than or equal to the enhanced coagulation Step 2 target pH shown in the following table 215-4:

TABLE 215-4 ENHANCED COAGULATION STEP 2 TARGET pH	
ALKALINITY (mg/L as CaCO ₃)	TARGET pH
0-60	5.5
>60-120	6.3
>120-240	7.0
>240	7.5

(iii) For waters with alkalinities of less than 60 mg/L for which addition of small amounts of alum or equivalent addition of iron coagulant drives the pH below 5.5 before significant TOC removal occurs, the system shall add necessary chemicals to maintain the pH between 5.3 and 5.7 in samples until the TOC removal of 0.3 mg/L per 10 mg/L alum added (or equivalent addition of iron coagulant) is reached.

(iv) The system may operate at any coagulant dose or pH necessary (consistent with other NPDWRs) to achieve the minimum TOC percent removal approved under paragraph (2)(c) of this section.

(v) If the TOC removal is consistently less than 0.3 mg/L of TOC per 10 mg/L of incremental alum dose at all dosages of alum (or equivalent addition of iron coagulant), the water is deemed to contain TOC not amenable to enhanced coagulation. The system may then apply to the Executive Secretary for a waiver of enhanced coagulation requirements.

(3) Compliance Calculations.

(a) Surface Water Systems other than those identified in paragraphs (1)(b) or (1)(c) of this section shall comply with requirements contained in paragraphs (2)(b) or (2)(c) of this section. Systems shall calculate compliance quarterly, beginning after the system has collected 12 months of data, by determining an annual average using the following method:

(i) Determine actual monthly TOC percent removal, equal to: $(1 - (\text{treated water TOC} / \text{source water TOC})) \times 100$.

(ii) Determine the required monthly TOC percent removal (from either the table in paragraph (2)(b) of this section or from paragraph (2)(c) of this section).

(iii) Divide the value in paragraph (3)(a)(i) of this section by the value in paragraph (3)(a)(ii) of this section.

(iv) Add together the results of paragraph (3)(a)(iii) of this section for the last 12 months and divide by 12.

(v) If the value calculated in paragraph (3)(a)(iv) of this section is less than 1.00, the system is not in compliance with the TOC percent removal requirements.

(b) Systems may use the provisions in paragraphs (3)(b)(i) through (v) of this section in lieu of the calculations in paragraph (3)(a)(i) through (v) of this section to determine compliance with TOC percent removal requirements.

(i) In any month that the system's treated or source water TOC level, measured according to R309-200-4(3), is less than 2.0 mg/L, the system may assign a monthly value of 1.0 (in lieu of the value calculated in paragraph (3)(a)(iii) of this section) when calculating compliance under the provisions of paragraph (3)(a) of this section.

(ii) In any month that a system practicing softening removes at least 10 mg/L of magnesium hardness (as CaCO₃), the system may assign a monthly value of 1.0 (in lieu of the value calculated in paragraph

(3)(a)(iii) of this section) when calculating compliance under the provisions of paragraph (3)(a) of this section.

(iii) In any month that the system's source water SUVA, prior to any treatment and measured according to R309-200-4(3), is less than or equal to 2.0 L/mg-m, the system may assign a monthly value of 1.0 (in lieu of the value calculated in paragraph (3)(a)(iii) of this section) when calculating compliance under the provisions of paragraph (3)(a) of this section.

(iv) In any month that the system's finished water SUVA, measured according to R309-200-4(3), is less than or equal to 2.0 L/mg-m, the system may assign a monthly value of 1.0 (in lieu of the value calculated in paragraph (3)(a)(iii) of this section) when calculating compliance under the provisions of paragraph (3)(a) of this section.

(v) In any month that a system practicing enhanced softening lowers alkalinity below 60 mg/L (as CaCO₃), the system may assign a monthly value of 1.0 (in lieu of the value calculated in paragraph (3)(a)(iii) of this section) when calculating compliance under the provisions of paragraph (3)(a) of this section.

(c) Surface Water Systems using conventional treatment may also comply with the requirements of this section by meeting the criteria in paragraph (1)(b) or (c) of this section.

(4) Treatment Technique Requirements for DBP Precursors.

The Executive Secretary identifies the following as treatment techniques to control the level of disinfection byproduct precursors in drinking water treatment and distribution systems: For Surface Water Systems using conventional treatment, enhanced coagulation or enhanced softening.

R309-215-14. Disinfection Profiling and Benchmarking.

A disinfection profile is a graphical representation of your system's level of *Giardia lamblia* or virus inactivation measured during the course of a year. Community or non-transient non-community water systems which use surface water or ground water under the direct influence of surface must develop a disinfection profile unless the Executive Secretary determines that a system's profile is unnecessary. The Executive Secretary may approve the use of a more representative data set for disinfection profiling than the data set required under R309-215-14.

(1) Determination of systems required to profile. A public water system subject to the requirements of this subpart shall determine its TTHM annual average using the

procedure in paragraph (1)(a) of this section and its HAA5 annual average using the procedure in paragraph (1)(b) of this section. The annual average is the arithmetic average of the quarterly averages of four consecutive quarters of monitoring.

(a) The TTHM annual average shall be the annual average during the same period as is used for the HAA5 annual average.

(i) Those systems that collected data under the provisions of 40 CFR 141.142 subpart M (Information Collection Rule) shall use the results of the samples collected during the last four quarters of required monitoring.

(ii) Those systems that use grandfathered HAA5 occurrence data that meet the provisions of paragraph (1)(b)(ii) of this section shall use TTHM data collected at the same time under the provisions of R309-200-5(3)(c)(vii) and R309-210-9.

(iii) Those systems that use HAA5 occurrence data that meet the provisions of paragraph (1)(b)(iii)(A) of this section shall use TTHM data collected at the same time under the provisions of R309-200-5(3)(c)(vii) and R309-210-9.

(b) The HAA5 annual average shall be the annual average during the same period as is used for the TTHM annual average.

(i) Those systems that collected data under the provisions of 40 CFR 141.142 subpart M (Information Collection Rule) shall use the results of the samples collected during the last four quarters of required monitoring.

(ii) Those systems that have collected four quarters of HAA5 occurrence data that meets the routine monitoring sample number and location requirements for TTHM in R309-200-5(3)(c)(vii) and R309-210-9 and handling and analytical method requirements of R309-200-4(3) may use those data to determine whether the requirements of this section apply.

(iii) Those systems that have not collected four quarters of HAA5 occurrence data that meets the provisions of either paragraph (1)(b)(i) or (ii) of this section by March 16, 1999 shall either:

(A) Conduct monitoring for HAA5 that meets the routine monitoring sample number and location requirements for TTHM in R309-200-5(3)(c)(vii) and R309-210-9 and handling and analytical method requirements of R309-200-4(3) to determine the HAA5 annual average and whether the requirements of paragraph (2) of this section apply. This monitoring shall be completed so that the applicability determination can be made no later than March 31, 2000, or

(B) Comply with all other provisions of this section as if the HAA5 monitoring had been conducted and the results required compliance with paragraph (2) of this section.

(c) The system may request that the Executive Secretary approve a more representative annual data set than the data set determined under paragraph (1)(a) or (b) of this section for the purpose of determining applicability of the requirements of this section.

(d) The Executive Secretary may require that a system use a more representative annual data set than the data set determined under paragraph (1)(a) or (b) of this section for the purpose of determining applicability of the requirements of this section.

(e) The system shall submit data to the Executive Secretary on the schedule in paragraphs (1)(e)(i) through (v) of this section.

(i) Those systems that collected TTHM and HAA5 data under the provisions of subpart M (Information Collection Rule), as required by paragraphs (1)(a)(i) and (1)(b)(i) of this section, shall submit the results of the samples collected during the last 12 months of required monitoring under 40 CFR section 141.142 (Information Collection Rule) not later than December 31, 1999.

(ii) Those systems that have collected four consecutive quarters of HAA5 occurrence data that meets the routine monitoring sample number and location for TTHM in R309-200-5(3)(c)(vii) and R309-210-9 and handling and analytical method requirements of R309-200-4(3), as allowed by paragraphs (1)(a)(ii) and (1)(b)(ii) of this section, shall submit those data to the Executive Secretary not later April 16, 1999. Until the Executive Secretary has approved the data, the system shall conduct monitoring for HAA5 using the monitoring requirements specified under paragraph (1)(b)(iii) of this section.

(iii) Those systems that conduct monitoring for HAA5 using the monitoring requirements specified by paragraphs (1)(a)(iii) and (1)(b)(iii)(A) of this section, shall submit TTHM and HAA5 data not later than April 1, 2000.

(iv) Those systems that elect to comply with all other provisions of this section as if the HAA5 monitoring had been conducted and the results required compliance with this section, as allowed under paragraphs (1)(b)(iii)(B) of this section, shall notify the Executive Secretary in writing of their election not later than December 31, 1999.

(v) If the system elects to request that the Executive Secretary approve a more representative annual data set than the data set determined under paragraph (1)(b)(i) of this section, the system shall submit this request in writing not later than December 31, 1999.

(f) Any system having either a TTHM annual average greater than or equal to 0.064 mg/L or an HAA5 annual average greater than or equal to 0.048 mg/L during the period identified in paragraphs (1)(a) and (b) of this section shall comply with paragraph (2) of this section.

(g) The Executive Secretary may only determine that a system's profile is unnecessary if a system's TTHM and HAA5 levels are below 0.064 mg/L and 0.048 mg/L, respectively. To determine these levels, TTHM and HAA5 samples must be collected after January 1, 1998, during the month with the warmest water temperature, and at the point of maximum residence time in your distribution system. The Executive Secretary may approve a more representative TTHM and HAA5 data set to determine these levels.

(2) Disinfection profiling.

(a) Any system that is required by paragraph (1) of this section shall develop a disinfection profile of its disinfection practice for a period of up to three years. A disinfection profile consists of the following 3 steps:

(i) The system must collect data for several parameters from the plant over the course of 12 months. If your system serves between 500 and 9,999 persons you must begin to collect data no later than July 1, 2003. If your system serves fewer than 500 persons you must begin to collect data no later than January 1, 2004. If your system serves 10,000 persons or greater than the requirements of R309-215-14(2) are only required if it meets the criteria in paragraph R309-215-14(1)(f).

(ii) The system must use this data to calculate weekly log inactivation as discussed in paragraph (d) of this section.

(iii) The system must use these weekly log inactivations to develop a disinfection profile.

(b) The system shall monitor daily for a period of 12 consecutive calendar months to determine the total logs of inactivation for each day of operation, based on the CT_{99.9} values in Tables 1.1-1.6, 2.1, and 3.1 of Section 141.74(b)(3) in the code of Federal Regulations (also available from the Division), as appropriate, through the entire treatment plant. This system shall begin this monitoring not later than April 1, 2000. As a minimum, the system with a single point of disinfectant application prior to entrance to the distribution system shall conduct the monitoring in paragraphs (2)(b)(i) through (iv) of this section. A system with

more than one point of disinfectant application shall conduct the monitoring in paragraphs (2)(b)(i) through (iv) of this section for each disinfection segment. The system shall monitor the parameters necessary to determine the total inactivation ratio, using analytical methods in R309-200-4(3), as follows:

- (i) The temperature of the disinfected water shall be measured once per day at each residual disinfectant concentration sampling point during peak hourly flow.
- (ii) If the system uses chlorine, the pH of the disinfected water shall be measured once per day at each chlorine residual disinfectant concentration sampling point during peak hourly flow.
- (iii) The disinfectant contact time(s) ("T") shall be determined for each day during peak hourly flow.
- (iv) The residual disinfectant concentration(s) ("C") of the water before or at the first customer and prior to each additional point of disinfection shall be measured each day during peak hourly flow.
- (v) For systems serving less than 10,000 persons, the above parameters shall be monitored once per week on the same calendar day, over 12 consecutive months for the purposes of disinfection profiling.

(c) In lieu of the monitoring conducted under the provisions of paragraph (2)(b) of this section to develop the disinfection profile, the system may elect to meet the requirements of paragraph (2)(c)(i) of this section. In addition to the monitoring conducted under the provisions of paragraph (2)(b) of this section to develop the disinfection profile, the system may elect to meet the requirements of paragraph (2)(c)(ii) of this section.

(i) A PWS that has three years of existing operational data may submit those data, a profile generated using those data, and a request that the Executive Secretary approve use of those data in lieu of monitoring under the provisions of paragraph (2)(b) of this section not later than March 31, 2000. The Executive Secretary shall determine whether these operational data are substantially equivalent to data collected under the provisions of paragraph (2)(b) of this section. These data shall also be representative of *Giardia lamblia* inactivation through the entire treatment plant and not just of certain treatment segments. Until the Executive Secretary approves this request, the system is required to conduct monitoring under the provisions of paragraph (2)(b) of this section.

(ii) In addition to the disinfection profile generated under paragraph (2)(b) of this section, a PWS that has existing operational data may use those data to develop a disinfection profile for additional years. Such systems

may use these additional yearly disinfection profiles to develop a benchmark under the provisions of paragraph (3) of this section. The Executive Secretary shall determine whether these operational data are substantially equivalent to data collected under the provisions of paragraph (2)(b) of this section. These data shall also be representative of inactivation through the entire treatment plant and not just of certain treatment segments.

(d) The system shall calculate the total inactivation ratio as follows:

(i) If the system uses only one point of disinfectant application, the system may determine the total inactivation ratio for the disinfection segment based on either of the methods in paragraph (2)(d)(i)(A) or (2)(d)(i)(B) of this section.

(A) Determine one inactivation ratio ($CT_{calc}/CT_{99.9}$) before or at the first customer during peak hourly flow.

(B) Determine successive $CT_{calc}/CT_{99.9}$ values, representing sequential inactivation ratios, between the point of disinfectant application and a point before or at the first customer during peak hourly flow. Under this alternative, the system shall calculate the total inactivation ratio by determining ($CT_{calc}/CT_{99.9}$) for each sequence and then adding the ($CT_{calc}/CT_{99.9}$) values together to determine sum of ($CT_{calc}/CT_{99.9}$).

(ii) If the system uses more than one point of disinfectant application before the first customer, the system shall determine the CT value of each disinfection segment immediately prior to the next point of disinfectant application, or for the final segment, before or at the first customer, during peak hourly flow. The ($CT_{calc}/CT_{99.9}$) value of each segment and sum of ($CT_{calc}/CT_{99.9}$) shall be calculated using the method in paragraph (b)(4)(i) of this section.

(iii) The system shall determine the total logs of inactivation by multiplying the value calculated in paragraph (2)(d)(i) or (ii) of this section by 3.0.

(e) A system that uses either chloramines or ozone for primary disinfection shall also calculate the logs of inactivation for viruses using a method approved by the Executive Secretary.

(f) The system shall retain disinfection profile data in graphic form, as a spreadsheet, or in some other format acceptable to the Executive Secretary for review as part of sanitary surveys conducted by the Executive Secretary.

(3) Disinfection Benchmarking

(a) Any system required to develop a disinfection profile under the provisions of paragraphs (1) and (2) of this section and that decides to make a significant change to its disinfection practice shall consult with the Executive Secretary prior to making such change. Significant changes to disinfection practice are:

- (i) Changes to the point of disinfection;
- (ii) Changes to the disinfectant(s) used in the treatment plant;
- (iii) Changes to the disinfection process; and
- (iv) Any other modification identified by the Executive Secretary.

(b) Any system that is modifying its disinfection practice shall calculate its disinfection benchmark using the procedure specified in paragraphs (3)(b)(i) through (ii) of this section.

(i) For each year of profiling data collected and calculated under paragraph (2) of this section, the system shall determine the lowest average monthly *Giardia lamblia* inactivation in each year of profiling data. The system shall determine the average *Giardia lamblia* inactivation for each calendar month for each year of profiling data by dividing the sum of daily *Giardia lamblia* of inactivation by the number of values calculated for that month.

(ii) The disinfection benchmark is the lowest monthly average value (for systems with one year of profiling data) or average of lowest monthly average values (for systems with more than one year of profiling data) of the monthly logs of *Giardia lamblia* inactivation in each year of profiling data.

(c) A system that uses either chloramines, ozone or chlorine dioxide for primary disinfection must calculate the disinfection benchmark from the data the system collected for viruses to develop the disinfection profile in addition to the *Giardia lamblia* disinfection benchmark calculated under paragraph (b)(i) above. This viral benchmark must be calculated in the same manner used to calculate the *Giardia lamblia* disinfection benchmark in paragraph (b)(i).

(d) The system shall submit information in paragraphs (3)(d)(i) through (iv) of this section to the Executive Secretary as part of its consultation process.

- (i) A description of the proposed change;

- (ii) The disinfection profile for *Giardia lamblia* (and, if necessary, viruses) under paragraph (2) of this section and benchmark as required by paragraph (3)(b) of this section; and
- (iii) An analysis of how the proposed change will affect the current levels of disinfection.
- (iv) Any additional information requested by the Executive Secretary.

R309-215-15. Enhanced Treatment for Cryptosporidium (Federal Subpart W).

(1) General requirements.

- (a) The rule requirements of this section establish or extend treatment technique requirements in lieu of maximum contaminant levels for *Cryptosporidium*. These requirements are in addition to requirements for filtration and disinfection in R309-200 and other parts of R309-215.
- (b) Applicability. The requirements of this subpart apply to all surface water systems, which are public water systems supplied by a surface water source and public water systems supplied by a ground water source under the direct influence of surface water.
 - (i) Wholesale systems, as defined in R309-110, must comply with the requirements of this section based on the population of the largest system in the combined distribution system.
 - (ii) The requirements of this sub-section apply to systems required by these rules to provide filtration treatment, whether or not the system is currently operating a filtration system.
- (c) Requirements. Systems subject to this subpart must comply with the following requirements:
 - (i) Systems must conduct an initial and a second round of source water monitoring for each plant that treats a surface water or GWUDI source. This monitoring may include sampling for *Cryptosporidium*, *E. coli*, and turbidity as described in R309-215-15(2) through R309-215-15(7), to determine what level, if any, of additional *Cryptosporidium* treatment they must provide.

- (ii) Systems that plan to make a significant change to their disinfection practice must develop disinfection profiles and calculate disinfection benchmarks, as described in R309-215-15(9) through R309-215-15(10).
- (iii) Filtered systems must determine their *Cryptosporidium* treatment bin classification as described in R309-215-15(11) and provide additional treatment for *Cryptosporidium*, if required, as described in R309-215-15(12). Filtered must implement *Cryptosporidium* treatment according to the schedule in R309-215-14.
- (iv) Systems required to provide additional treatment for *Cryptosporidium* must implement microbial toolbox options that are designed and operated as described in R309-215-15(15) through R309-215-15(20).
- (v) Systems must comply with the applicable recordkeeping and reporting requirements described in R309-215-15(21) through R309-215-15(22).
- (vi) Systems must address significant deficiencies identified in sanitary surveys performed by EPA as described in R309-215-15(22).

(2) Source Water Monitoring Requirements.

- (a) Initial round of source water monitoring. Systems must conduct the following monitoring on the schedule in paragraph (c) of this section unless they meet the monitoring exemption criteria in paragraph (d) of this section.
 - (i) Filtered systems serving at least 10,000 people must sample their source water for *Cryptosporidium*, *E. coli*, and turbidity at least monthly for 24 months.
 - (ii) (A) Filtered systems serving fewer than 10,000 people must sample their source water for *E. coli* at least once every two weeks for 12 months.
 - (B) A filtered system serving fewer than 10,000 people may avoid *E. coli* monitoring if the system notifies the Executive Secretary that it will monitor for *Cryptosporidium* as described in paragraph (a)(iv) of this section. The system must notify the Executive Secretary no later than 3 months prior to the date the system is otherwise required to start *E. coli* monitoring under R309-215-15(2)(c).
 - (iii) Filtered systems serving fewer than 10,000 people must sample their source water for *Cryptosporidium* at least twice per month for 12 months

or at least monthly for 24 months if they meet one of the following, based on monitoring conducted under paragraph (a)(iii) of this section:

(A) For systems using lake/reservoir sources, the annual mean E. coli concentration is greater than 10 E. coli/ 100 mL.

(B) For systems using flowing stream sources, the annual mean E. coli concentration is greater than 50 E. coli/ 100 mL.

(C) The system does not conduct E. coli monitoring as described in paragraph (a)(iii) of this section.

(D) Systems using ground water under the direct influence of surface water (GWUDI) must comply with the requirements of paragraph (a)(iv) of this section based on the E. coli level that applies to the nearest surface water body. If no surface water body is nearby, the system must comply based on the requirements that apply to systems using lake/reservoir sources.

(iv) For filtered systems serving fewer than 10,000 people, the Executive Secretary may approve monitoring for an indicator other than E. coli under paragraph (a)(ii) of this section. The Executive Secretary also may approve an alternative to the E. coli concentration in paragraph (a)(iii)(A), (B) or (D) of this section to trigger Cryptosporidium monitoring. This approval by the Executive Secretary must be provided to the system in writing and must include the basis for the Executive Secretary's determination that the alternative indicator and/or trigger level will provide a more accurate identification of whether a system will exceed the Bin 1 Cryptosporidium level in R309-215-15(11).

(v) Systems may sample more frequently than required under this section if the sampling frequency is evenly spaced throughout the monitoring period.

(b) Second round of source water monitoring. Systems must conduct a second round of source water monitoring that meets the requirements for monitoring parameters, frequency, and duration described in paragraph (a) of this section, unless they meet the monitoring exemption criteria in paragraph (d) of this section. Systems must conduct this monitoring on the schedule in paragraph (c) of this section.

(c) Monitoring schedule. Systems must begin the monitoring required in paragraphs (a) and (b) of this section no later than the month beginning with the date listed:

(i) Systems that serve at least 100,000 people must:

(A) begin the first round of source water monitoring no later than October 1, 2006; and

(B) begin the second round of source water monitoring no later than April 1, 2015.

(ii) Systems that serve from 50,000 to 99,999 people must:

(A) begin the first round of source water monitoring no later than April 1, 2007; and

(B) begin the second round of source water monitoring no later than October 1, 2015.

(iii) Systems that serve from 10,000 to 49,999 people must:

(A) begin the first round of source water monitoring no later than April 1, 2008; and

(B) begin the second round of source water monitoring no later than October 1, 2016.

(iv) Systems that serve less than 10,000 people and monitor for E. coli must:

(A) begin the first round of source water monitoring no later than October 1, 2008; and

(B) begin the second round of source water monitoring no later than October 1, 2017.

(C) Applies only to filtered systems.

(v) Systems that serve less than 10,000 people and monitor for Cryptosporidium must:

(A) begin the first round of source water monitoring no later than April 1, 2010; and

(B) begin the second round of source water monitoring no later than April 1, 2019.

(C) Applies to filtered systems that meet the conditions of paragraph (a)(iii) of this section.

(d) Monitoring avoidance.

(i) Filtered systems are not required to conduct source water monitoring under this sub-section if the system will provide a total of at least 5.5-log of treatment for *Cryptosporidium*, equivalent to meeting the treatment requirements of Bin 4 in R309-215-15(12).

(ii) If a system chooses to provide the level of treatment in paragraph (d)(i) of this section rather than start source monitoring, the system must notify the Executive Secretary in writing no later than the date the system is otherwise required to submit a sampling schedule for monitoring under R309-215-15(3). Alternatively, a system may choose to stop sampling at any point after it has initiated monitoring if it notifies the Executive Secretary in writing that it will provide this level of treatment. Systems must install and operate technologies to provide this level of treatment by the applicable compliance dates in R309-215-15(13).

(e) Plants operating only part of the year. Systems with surface water plants that operate for only part of the year must conduct source water monitoring in accordance with this subpart, but with the following modifications:

(i) Systems must sample their source water only during the months that the plant operates unless the Executive Secretary specifies another monitoring period based on plant operating practices.

(ii) Systems with plants that operate less than six months per year and that monitor for *Cryptosporidium* must collect at least six *Cryptosporidium* samples per year during each of two years of monitoring. Samples must be evenly spaced throughout the period the plant operates.

(f) (i) New sources. A system that begins using a new source of surface water or GWUDI after the system is required to begin monitoring under paragraph (c) of this section must monitor the new source on a schedule the Executive Secretary approves. Source water monitoring must meet the requirements of this sub-section. The system must also meet the bin classification and *Cryptosporidium* treatment requirements of R309-215-15(11) and (12) for the new source on a schedule the Executive Secretary approves.

(ii) The requirements of R309-215-15(2)(f) apply to surface water systems that begin operation after the monitoring start date applicable to the system's size under paragraph (c) of this section.

(iii) The system must begin a second round of source water monitoring no later than 6 years following initial bin classification under R309-215-15(11).

(g) Failure to collect any source water sample required under this section in accordance with the sampling schedule, sampling location, analytical method, approved laboratory, and reporting requirements of R309-215-15(3) through R309-215-15(7) is a monitoring violation.

(h) Grandfathering monitoring data. Systems may use (grandfather) monitoring data collected prior to the applicable monitoring start date in paragraph (c) of this section to meet the initial source water monitoring requirements in paragraph (a) of this section. Grandfathered data may substitute for an equivalent number of months at the end of the monitoring period. All data submitted under this paragraph must meet the requirements in R309-215-15(8).

(3) Sampling schedules.

(a) Systems required to conduct source water monitoring under R309-215-15(2) must submit a sampling schedule that specifies the calendar dates when the system will collect each required sample.

(i) Systems must submit sampling schedules no later than 3 months prior to the applicable date listed in R309-215-15(2)(c) for each round of required monitoring.

(ii) (A) Systems serving at least 10,000 people must submit their sampling schedule for the initial round of source water monitoring under R309-215-15(2)(a) to EPA electronically at [https:// intranet.epa.gov/lt2/](https://intranet.epa.gov/lt2/).

(B) If a system is unable to submit the sampling schedule electronically, the system may use an alternative approach for submitting the sampling schedule that EPA approves.

(iii) Systems serving fewer than 10,000 people must submit their sampling schedules for the initial round of source water monitoring R309-215-15(2)(a) to the Executive Secretary.

(iv) Systems must submit sampling schedules for the second round of source water monitoring R309-215-15(2)(b) to the Executive Secretary.

(v) If EPA or the Executive Secretary does not respond to a system regarding its sampling schedule, the system must sample at the reported schedule.

(b) Systems must collect samples within two days before or two days after the dates indicated in their sampling schedule (i.e., within a five-day period around the schedule date) unless one of the conditions of paragraph (b)(i) or (ii) of this section applies.

(i) If an extreme condition or situation exists that may pose danger to the sample collector, or that cannot be avoided and causes the system to be unable to sample in the scheduled five-day period, the system must sample as close to the scheduled date as is feasible unless the Executive Secretary approves an alternative sampling date. The system must submit an explanation for the delayed sampling date to the Executive Secretary concurrent with the shipment of the sample to the laboratory.

(ii) (A) If a system is unable to report a valid analytical result for a scheduled sampling date due to equipment failure, loss of or damage to the sample, failure to comply with the analytical method requirements, including the quality control requirements in R309-215-15(5), or the failure of an approved laboratory to analyze the sample, then the system must collect a replacement sample.

(B) The system must collect the replacement sample not later than 21 days after receiving information that an analytical result cannot be reported for the scheduled date unless the system demonstrates that collecting a replacement sample within this time frame is not feasible or the Executive Secretary approves an alternative resampling date. The system must submit an explanation for the delayed sampling date to the Executive Secretary concurrent with the shipment of the sample to the laboratory.

(c) Systems that fail to meet the criteria of paragraph (b) of this section for any source water sample required under R309-215-15(2) must revise their sampling schedules to add dates for collecting all missed samples. Systems must submit the revised schedule to the Executive Secretary for approval prior to when the system begins collecting the missed samples.

(4) Sampling locations.

(a) Systems required to conduct source water monitoring under R309-215-15(2) must collect samples for each plant that treats a surface water or GWUDI source. Where multiple plants draw water from the same influent, such as the same pipe or intake, the Executive Secretary may approve one set of monitoring results to be used to satisfy the requirements of R309-215-15(2) for all plants.

(b) (i) Systems must collect source water samples prior to chemical treatment, such as coagulants, oxidants and disinfectants, unless the system meets the condition of paragraph (b)(ii) of this section.

(ii) The Executive Secretary may approve a system to collect a source water sample after chemical treatment. To grant this approval, the

Executive Secretary must determine that collecting a sample prior to chemical treatment is not feasible for the system and that the chemical treatment is unlikely to have a significant adverse effect on the analysis of the sample.

(c) Systems that recycle filter backwash water must collect source water samples prior to the point of filter backwash water addition.

(d) Bank filtration.

(i) Systems that receive *Cryptosporidium* treatment credit for bank filtration under R309-200-5(5)(a)(ii) must collect source water samples in the surface water prior to bank filtration.

(ii) Systems that use bank filtration as pretreatment to a filtration plant must collect source water samples from the well (i.e., after bank filtration). Use of bank filtration during monitoring must be consistent with routine operational practice. Systems collecting samples after a bank filtration process may not receive treatment credit for the bank filtration under R309-215-15(16)(c).

(e) Multiple sources. Systems with plants that use multiple water sources, including multiple surface water sources and blended surface water and ground water sources, must collect samples as specified in paragraph (e)(i) or (ii) of this section. The use of multiple sources during monitoring must be consistent with routine operational practice.

(i) If a sampling tap is available where the sources are combined prior to treatment, systems must collect samples from the tap.

(ii) If a sampling tap where the sources are combined prior to treatment is not available, systems must collect samples at each source near the intake on the same day and must follow either paragraph (e)(ii)(A) or (B) of this section for sample analysis.

(A) Systems may composite samples from each source into one sample prior to analysis. The volume of sample from each source must be weighted according to the proportion of the source in the total plant flow at the time the sample is collected.

(B) Systems may analyze samples from each source separately and calculate a weighted average of the analysis results for each sampling date. The weighted average must be calculated by multiplying the analysis result for each source by the fraction the source contributed to total plant flow at the time the sample was collected and then summing these values.

(f) Additional Requirements. Systems must submit a description of their sampling location(s) to the Executive Secretary at the same time as the sampling schedule required under R309-215-15(3). This description must address the position of the sampling location in relation to the system's water source(s) and treatment processes, including pretreatment, points of chemical treatment, and filter backwash recycle. If the Executive Secretary does not respond to a system regarding sampling location(s), the system must sample at the reported location(s).

(5) Analytical methods.

(a) Cryptosporidium. Systems must analyze for Cryptosporidium using Method 1623: Cryptosporidium and Giardia in Water by Filtration/IMS/FA, 2005, United States Environmental Protection Agency, EPA-815-R-05-002 or Method 1622: Cryptosporidium in Water by Filtration/IMS/FA, 2005, United States Environmental Protection Agency, EPA-815-R-05-001, which are incorporated by reference. You may obtain a copy of these methods online from <http://www.epa.gov/safewater/disinfection/lt2> or from the United States Environmental Protection Agency, Office of Ground Water and Drinking Water, 1201 Constitution Ave., NW, Washington, DC 20460 (Telephone: 800-426-4791). You may inspect a copy at the Water Docket in the EPA Docket Center, 1301 Constitution Ave., NW, Washington, DC, (Telephone: 202-566-2426) or at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030, or go to: http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html. You may also obtain a copy of these methods by contacting the Division of Drinking Water at 801-536-4200.

(i) Systems must analyze at least a 10 L sample or a packed pellet volume of at least 2 mL as generated by the methods listed in paragraph (a) of this section. Systems unable to process a 10 L sample must analyze as much sample volume as can be filtered by two filters approved by EPA for the methods listed in paragraph (a) of this section, up to a packed pellet volume of at least 2 mL.

(ii) (A) Matrix spike (MS) samples, as required by the methods in paragraph (a) of this section, must be spiked and filtered by a laboratory approved for Cryptosporidium analysis under R309-215-15(6).

(B) If the volume of the MS sample is greater than 10 L, the system may filter all but 10 L of the MS sample in the field, and ship the filtered sample and the remaining 10 L of source water to the laboratory. In this case, the laboratory must spike the

remaining 10 L of water and filter it through the filter used to collect the balance of the sample in the field.

(iii) Flow cytometer-counted spiking suspensions must be used for MS samples and ongoing precision and recovery (OPR) samples.

(b) *E. coli*. Systems must use methods for enumeration of *E. coli* in source water approved in R309-200-4(3) and (4).

(i) The time from sample collection to initiation of analysis may not exceed 30 hours unless the system meets the condition of paragraph (b)(ii) of this section.

(ii) The Executive Secretary may approve on a case-by-case basis the holding of an *E. coli* sample for up to 48 hours between sample collection and initiation of analysis if the Executive Secretary determines that analyzing an *E. coli* sample within 30 hours is not feasible. *E. coli* samples held between 30 to 48 hours must be analyzed by the Colilert reagent version of Standard Method 9223B as listed in R309-200-4(3) and (4).

(iii) Systems must maintain samples between 0 deg.C and 10 deg. C during storage and transit to the laboratory.

(c) Turbidity. Systems must use methods for turbidity measurement approved in R309-200-4(3) and (4).

(6) Approved laboratories.

(a) *Cryptosporidium*. Systems must have *Cryptosporidium* samples analyzed by a laboratory that is approved under EPA's Laboratory Quality Assurance Evaluation Program for Analysis of *Cryptosporidium* in Water or a laboratory that has been certified for *Cryptosporidium* analysis by an equivalent State laboratory certification program.

(b) *E. coli*. Any laboratory certified by the EPA, the National Environmental Laboratory Accreditation Conference or the State for total coliform or fecal coliform analysis under R309-200-4(3) and (4) is approved for *E. coli* analysis under this subpart when the laboratory uses the same technique for *E. coli* that the laboratory uses for R309-200-4(3), (4) and in R444-14-4(1).

(c) Turbidity. Measurements of turbidity must be made by a party approved by the State.

(7) Reporting source water monitoring results.

(a) Systems must report results from the source water monitoring required under R309-215-15(2) no later than 10 days after the end of the first month following the month when the sample is collected.

(b) (i) All systems serving at least 10,000 people must report the results from the initial source water monitoring required under R309-215-15(2)(a) to EPA electronically at [https:// intranet.epa.gov/lt2/](https://intranet.epa.gov/lt2/).

(ii) If a system is unable to report monitoring results electronically, the system may use an alternative approach for reporting monitoring results that EPA approves.

(c) Systems serving fewer than 10,000 people must report results from the initial source water monitoring required under R309-215-15(2)(a) to the Executive Secretary.

(d) All systems must report results from the second round of source water monitoring required under R309-215-15(2)(b) to the Executive Secretary.

(e) Systems must report the applicable information in paragraphs (e)(i) and (ii) of this section for the source water monitoring required under R309-215-15(2).

(i) Systems must report the following data elements for each *Cryptosporidium* analysis:

(A) PWS ID.

(B) Facility ID.

(C) Sample collection date.

(D) Sample type (field or matrix spike).

(E) Sample volume filtered (L), to nearest 1/4 L.

(F) Was 100% of filtered volume examined.

(G) Number of oocysts counted.

(H) For matrix spike samples, systems must also report the sample volume spiked and estimated number of oocysts spiked. These data are not required for field samples.

(I) For samples in which less than 10 L is filtered or less than 100% of the sample volume is examined, systems must also report the number of filters used and the packed pellet volume.

(J) For samples in which less than 100% of sample volume is examined, systems must also report the volume of resuspended concentrate and volume of this resuspension processed through immunomagnetic separation.

(ii) Systems must report the following data elements for each *E. coli* analysis:

(A) PWS ID.

(B) Facility ID.

(C) Sample collection date.

(D) Analytical method number.

(E) Method type.

(F) Source type (flowing stream, lake/reservoir, GWUDI).

(G) *E. coli*/100 mL.

(H) Turbidity. (Systems serving fewer than 10,000 people that are not required to monitor for turbidity under R309-215-15(2) are not required to report turbidity with their *E. coli* results.)

(8) Grandfathering previously collected data.

(a) (i) Systems may comply with the initial source water monitoring requirements of R309-215-15(2)(a) by grandfathering sample results collected before the system is required to begin monitoring (i.e., previously collected data). To be grandfathered, the sample results and analysis must meet the criteria in this section and the Executive Secretary must approve.

(ii) A filtered system may grandfather *Cryptosporidium* samples to meet the requirements of R309-215-15(2)(a) when the system does not have corresponding *E. coli* and turbidity samples. A system that grandfathers *Cryptosporidium* samples without *E. coli* and turbidity samples is not required to collect *E. coli* and turbidity samples when the system completes the requirements for *Cryptosporidium* monitoring under R309-215-15(2)(a).

(b) *E. coli* sample analysis. The analysis of *E. coli* samples must meet the analytical method and approved laboratory requirements of R309-215-15(5) through R309-215-15(6).

(c) *Cryptosporidium* sample analysis. The analysis of *Cryptosporidium* samples must meet the criteria in this paragraph.

(i) Laboratories analyzed *Cryptosporidium* samples using one of the analytical methods in paragraphs (c)(i)(A) through (D) of this section, which are incorporated by reference. You may obtain a copy of these methods on-line from the United States Environmental Protection Agency, Office of Ground Water and Drinking Water, 1201 Constitution Ave, NW, Washington, DC 20460 (Telephone: 800-426-4791). You may inspect a copy at the Water Docket in the EPA Docket Center, 1301 Constitution Ave., NW, Washington, DC, (Telephone: 202-566-2426) or at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030, or go to: http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html. You may also obtain a copy of these methods by contacting the Division of Drinking Water at 801-536-4200.

(A) Method 1623: *Cryptosporidium* and *Giardia* in Water by Filtration/IMS/ FA, 2005, United States Environmental Protection Agency, EPA-815-R-05-002.

(B) Method 1622: *Cryptosporidium* in Water by Filtration/IMS/FA, 2005, United States Environmental Protection Agency, EPA-815-R-05-001.

(C) Method 1623: *Cryptosporidium* and *Giardia* in Water by Filtration/IMS/ FA, 2001, United States Environmental Protection Agency, EPA-821-R-01-025.

(D) Method 1622: *Cryptosporidium* in Water by Filtration/IMS/FA, 2001, United States Environmental Protection Agency, EPA-821-R-01-026.

(E) Method 1623: *Cryptosporidium* and *Giardia* in Water by Filtration/IMS/ FA, 1999, United States Environmental Protection Agency, EPA-821-R-99-006.

(F) Method 1622: *Cryptosporidium* in Water by Filtration/IMS/FA, 1999, United States Environmental Protection Agency, EPA-821-R-99-001.

(ii) For each *Cryptosporidium* sample, the laboratory analyzed at least 10 L of sample or at least 2 mL of packed pellet or as much volume as could be filtered by 2 filters that EPA approved for the methods listed in paragraph (c)(1) of this section.

(d) Sampling location. The sampling location must meet the conditions in R309-215-15(4).

(e) Sampling frequency. *Cryptosporidium* samples were collected no less frequently than each calendar month on a regular schedule, beginning no earlier than January 1999. Sample collection intervals may vary for the conditions specified in R309-215-15(3)(b)(i) and (ii) if the system provides documentation of the condition when reporting monitoring results.

(i) The Executive Secretary may approve grandfathering of previously collected data where there are time gaps in the sampling frequency if the system conducts additional monitoring the Executive Secretary specifies to ensure that the data used to comply with the initial source water monitoring requirements of R309-215-15(2)(a) are seasonally representative and unbiased.

(ii) Systems may grandfather previously collected data where the sampling frequency within each month varied. If the *Cryptosporidium* sampling frequency varied, systems must follow the monthly averaging procedure in R309-215-15(11)(b)(v) when calculating the bin classification for filtered systems.

(f) Reporting monitoring results for grandfathering. Systems that request to grandfather previously collected monitoring results must report the following information by the applicable dates listed in this paragraph. Systems serving at least 10,000 people must report this information to EPA unless the Executive Secretary approves reporting to the Executive Secretary rather than EPA. Systems serving fewer than 10,000 people must report this information to the Executive Secretary.

(i) Systems must report that they intend to submit previously collected monitoring results for grandfathering. This report must specify the number of previously collected results the system will submit, the dates of the first and last sample, and whether a system will conduct additional source water monitoring to meet the requirements of R309-215-15(2)(a). Systems must report this information no later than the date the sampling schedule under R309-215-15(3) is required.

(ii) Systems must report previously collected monitoring results for grandfathering, along with the associated documentation listed in

paragraphs (f)(ii)(A) through (D) of this section, no later than two months after the applicable date listed in R309-215-15(2)(c).

(A) For each sample result, systems must report the applicable data elements in R309-215-15(7).

(B) Systems must certify that the reported monitoring results include all results the system generated during the time period beginning with the first reported result and ending with the final reported result. This applies to samples that were collected from the sampling location specified for source water monitoring under this subpart, not spiked, and analyzed using the laboratory's routine process for the analytical methods listed in this section.

(C) Systems must certify that the samples were representative of a plant's source water(s) and the source water(s) have not changed. Systems must report a description of the sampling location(s), which must address the position of the sampling location in relation to the system's water source(s) and treatment processes, including points of chemical addition and filter backwash recycle.

(D) For *Cryptosporidium* samples, the laboratory or laboratories that analyzed the samples must provide a letter certifying that the quality control criteria specified in the methods listed in paragraph (c)(i) of this section were met for each sample batch associated with the reported results. Alternatively, the laboratory may provide bench sheets and sample examination report forms for each field, matrix spike, IPR, OPR, and method blank sample associated with the reported results.

(g) If the Executive Secretary determines that a previously collected data set submitted for grandfathering was generated during source water conditions that were not normal for the system, such as a drought, the Executive Secretary may disapprove the data. Alternatively, the Executive Secretary may approve the previously collected data if the system reports additional source water monitoring data, as determined by the Executive Secretary, to ensure that the data set used under R309-215-15(11) represents average source water conditions for the system.

(h) If a system submits previously collected data that fully meet the number of samples required for initial source water monitoring under R309-215-15(2)(a) and some of the data are rejected due to not meeting the requirements of this section, systems must conduct additional monitoring to replace rejected data on a schedule the Executive Secretary approves. Systems are not required to begin this additional monitoring until two months after notification that data have been rejected and additional monitoring is necessary.

(9) Disinfection Profiling and Benchmarking Requirements –

Requirements when making a significant change in disinfection practice.

(a) Following the completion of initial source water monitoring under R309-215-15(2)(a), a system that plans to make a significant change to its disinfection practice, as defined in paragraph (b) of this section, must develop disinfection profiles and calculate disinfection benchmarks for *Giardia lamblia* and viruses as described in R309-215-15(10). Prior to changing the disinfection practice, the system must notify the Executive Secretary and must include in this notice the information in paragraphs (a)(i) through (iii) of this section.

(i) A completed disinfection profile and disinfection benchmark for *Giardia lamblia* and viruses as described in R309-215-15(10).

(ii) A description of the proposed change in disinfection practice.

(iii) An analysis of how the proposed change will affect the current level of disinfection.

(b) Significant changes to disinfection practice are defined as follows:

(i) Changes to the point of disinfection;

(ii) Changes to the disinfectant(s) used in the treatment plant;

(iii) Changes to the disinfection process; or

(iv) Any other modification identified by the Executive Secretary as a significant change to disinfection practice.

(10) Developing the disinfection profile and benchmark.

(a) Systems required to develop disinfection profiles under R309-215-15(9) must follow the requirements of this section. Systems must monitor at least weekly for a period of 12 consecutive months to determine the total log inactivation for *Giardia lamblia* and viruses. If systems monitor more frequently, the monitoring frequency must be evenly spaced. Systems that operate for fewer than 12 months per year must monitor weekly during the period of operation. Systems must determine log inactivation for *Giardia lamblia* through the entire plant, based on CT 99.9 values in Tables 1.1 through 1.6, 2.1 and 3.1 of Section 141.74(b) in the code of Federal Regulations as applicable (available from the Division). Systems

must determine log inactivation for viruses through the entire treatment plant based on a protocol approved by the Executive Secretary.

(b) Systems with a single point of disinfectant application prior to the entrance to the distribution system must conduct the monitoring in paragraphs (b)(i) through (iv) of this section. Systems with more than one point of disinfectant application must conduct the monitoring in paragraphs (b)(i) through (iv) of this section for each disinfection segment. Systems must monitor the parameters necessary to determine the total inactivation ratio, using analytical methods in R309-200-4(3) and (4).

(i) For systems using a disinfectant other than UV, the temperature of the disinfected water must be measured at each residual disinfectant concentration sampling point during peak hourly flow or at an alternative location approved by the Executive Secretary.

(ii) For systems using chlorine, the pH of the disinfected water must be measured at each chlorine residual disinfectant concentration sampling point during peak hourly flow or at an alternative location approved by the Executive Secretary.

(iii) The disinfectant contact time(s) (t) must be determined during peak hourly flow.

(iv) The residual disinfectant concentration(s) (C) of the water before or at the first customer and prior to each additional point of disinfectant application must be measured during peak hourly flow.

(c) In lieu of conducting new monitoring under paragraph (b) of this section, systems may elect to meet the requirements of paragraphs (c)(i) or (ii) of this section.

(i) Systems that have at least one year of existing data that are substantially equivalent to data collected under the provisions of paragraph (b) of this section may use these data to develop disinfection profiles as specified in this section if the system has neither made a significant change to its treatment practice nor changed sources since the data were collected. Systems may develop disinfection profiles using up to three years of existing data.

(ii) Systems may use disinfection profile(s) developed under R309-215-14 in lieu of developing a new profile if the system has neither made a significant change to its treatment practice nor changed sources since the profile was developed. Systems that have not developed a virus profile under R309-251-14 must develop a virus profile using the same monitoring data on which the *Giardia lamblia* profile is based.

(d) Systems must calculate the total inactivation ratio for *Giardia lamblia* as specified in paragraphs (d)(i) through (iii) of this section.

(i) Systems using only one point of disinfectant application may determine the total inactivation ratio for the disinfection segment based on either of the methods in paragraph (d)(1)(i) or (ii) of this section.

(A) Determine one inactivation ratio ($CT_{calc}/CT_{99.9}$) before or at the first customer during peak hourly flow.

(B) Determine successive $CT_{calc}/CT_{99.9}$ values, representing sequential inactivation ratios, between the point of disinfectant application and a point before or at the first customer during peak hourly flow. The system must calculate the total inactivation ratio by determining ($CT_{calc}/CT_{99.9}$) for each sequence and then adding the ($CT_{calc}/CT_{99.9}$) values together to determine the sum of ($CT_{calc}/CT_{99.9}$).

(ii) Systems using more than one point of disinfectant application before the first customer must determine the CT value of each disinfection segment immediately prior to the next point of disinfectant application, or for the final segment, before or at the first customer, during peak hourly flow. The ($CT_{calc}/CT_{99.9}$) value of each segment and the sum of ($CT_{calc}/CT_{99.9}$) must be calculated using the method in paragraph (d)(i)(B) of this section.

(iii) The system must determine the total logs of inactivation by multiplying the value calculated in paragraph (d)(i) or (d)(ii) of this section by 3.0.

(iv) Systems must calculate the log of inactivation for viruses using a protocol approved by the Executive Secretary.

(e) Systems must use the procedures specified in paragraphs (e)(i) and (ii) of this section to calculate a disinfection benchmark.

(i) For each year of profiling data collected and calculated under paragraphs (a) through (d) of this section, systems must determine the lowest mean monthly level of both *Giardia lamblia* and virus inactivation. Systems must determine the mean *Giardia lamblia* and virus inactivation for each calendar month for each year of profiling data by dividing the sum of daily or weekly *Giardia lamblia* and virus log inactivation by the number of values calculated for that month.

- (ii) The disinfection benchmark is the lowest monthly mean value (for systems with one year of profiling data) or the mean of the lowest monthly mean values (for systems with more than one year of profiling data) of *Giardia lamblia* and virus log inactivation in each year of profiling data.

(11) Treatment Technique Requirements - Bin classification for filtered systems.

(a) Following completion of the initial round of source water monitoring required under R309-215-15(2)(a), filtered systems must calculate an initial *Cryptosporidium* bin concentration for each plant for which monitoring was required. Calculation of the bin concentration must use the *Cryptosporidium* results reported under R309-215-15(2)(a) and must follow the procedures in paragraphs (b)(i) through (v) of this section.

(b) (i) For systems that collect a total of at least 48 samples, the bin concentration is equal to the arithmetic mean of all sample concentrations.

(ii) For systems that collect a total of at least 24 samples, but not more than 47 samples, the bin concentration is equal to the highest arithmetic mean of all sample concentrations in any 12 consecutive months during which *Cryptosporidium* samples were collected.

(iii) For systems that serve fewer than 10,000 people and monitor for *Cryptosporidium* for only one year (i.e., collect 24 samples in 12 months), the bin concentration is equal to the arithmetic mean of all sample concentrations.

(iv) For systems with plants operating only part of the year that monitor fewer than 12 months per year under R309-215-15(2)(e), the bin concentration is equal to the highest arithmetic mean of all sample concentrations during any year of *Cryptosporidium* monitoring.

(v) If the monthly *Cryptosporidium* sampling frequency varies, systems must first calculate a monthly average for each month of monitoring. Systems must then use these monthly average concentrations, rather than individual sample concentrations, in the applicable calculation for bin classification in paragraphs (b)(i) through (iv) of this section.

(c) Filtered systems must determine their initial bin classification from the following and using the *Cryptosporidium* bin concentration calculated under paragraphs (a) and (b) of this section:

(i) Systems that are required to monitor for *Cryptosporidium* under R309-215-15(2):

(A) with a cryptosporidium concentration of less than 0.075 oocysts/L, the bin classification is Bin 1.

(B) with a cryptosporidium concentration of 0.075 oocysts/L to less than 1.0 oocysts/L, the bin classification is Bin 2.

(C) with a cryptosporidium concentration of 1.0 oocysts/L to less than 3.0 oocysts/L, the bin classification is Bin 3.

(D) with a cryptosporidium concentration of equal to or greater than 3.0 oocysts/L, the bin classification is Bin 4.

(ii) Systems serving fewer than 10,000 people and not required to monitor for Cryptosporidium under R309-215-15(2)(a)(iii), the concentration of cryptosporidium is not applicable and their bin classification is Bin 1.

(iii) Based on calculations in paragraph (a) or (d) of this section, as applicable.

(d) Following completion of the second round of source water monitoring required under R309-215-15(2)(b), filtered systems must recalculate their Cryptosporidium bin concentration using the Cryptosporidium results reported under R309-215-15(2)(b) and following the procedures in paragraphs (b)(i) through (iv) of this section. Systems must then redetermine their bin classification using this bin concentration and the table in paragraph (c) of this section.

(e) (i) Filtered systems must report their initial bin classification under paragraph (c) of this section to the Executive Secretary for approval no later than 6 months after the system is required to complete initial source water monitoring based on the schedule in R309-215-15(2)(c).

(ii) Systems must report their bin classification under paragraph (d) of this section to the Executive Secretary for approval no later than 6 months after the system is required to complete the second round of source water monitoring based on the schedule in R309-215-15(2)(c).

(iii) The bin classification report to the Executive Secretary must include a summary of source water monitoring data and the calculation procedure used to determine bin classification.

(f) Failure to comply with the conditions of paragraph (e) of this section is a violation of the treatment technique requirement.

(12) Filtered system additional Cryptosporidium treatment requirements.

(a) Filtered systems must provide the level of additional treatment for Cryptosporidium specified in this paragraph based on their bin classification as determined under R309-215-15(11) and according to the schedule in R309-215-15(13). The filtration treatment used by the system in this paragraph must be utilized in full compliance with the requirements of R309-200-5(5), R309-200-7, R309-215-8 and 9.

(i) If the system bin classification is Bin 1 and the system uses:

(A) Conventional filtration treatment including softening there is no additional cryptosporidium treatment required.

(B) Direct filtration there is no additional cryptosporidium treatment required.

(C) Slow sand or diatomaceous earth filtration there is no additional cryptosporidium treatment required.

(D) Alternative filtration technologies there is no additional cryptosporidium treatment required.

(ii) If the system bin classification is Bin 2 and the system uses:

(A) Conventional filtration treatment including softening there is an additional 1-log cryptosporidium treatment required.

(B) Direct filtration there is an additional 1.5-log cryptosporidium treatment required.

(C) Slow sand or diatomaceous earth filtration there is an additional 1-log cryptosporidium treatment required.

(D) Alternative filtration technologies there is an additional cryptosporidium treatment required as determined by the Executive Secretary such that the total Cryptosporidium removal an inactivation is at least 4.0-log.

(iii) If the system bin classification is Bin 3 and the system uses:

(A) Conventional filtration treatment including softening there is an additional 2-log cryptosporidium treatment required.

(B) Direct filtration there is an additional 2.5-log cryptosporidium treatment required.

(C) Slow sand or diatomaceous earth filtration there is an additional 2-log cryptosporidium treatment required.

(D) Alternative filtration technologies there is an additional cryptosporidium treatment required as determined by the Executive Secretary such that the total Cryptosporidium removal an inactivation is at least 5.0-log.

(iv) If the system bin classification is Bin 4 and the system uses:

(A) Conventional filtration treatment including softening there is an additional 2.5-log cryptosporidium treatment required.

(B) Direct filtration there is an additional 3-log cryptosporidium treatment required.

(C) Slow sand or diatomaceous earth filtration there is an additional 2.5-log cryptosporidium treatment required.

(D) Alternative filtration technologies there is an additional cryptosporidium treatment required as determined by the Executive Secretary such that the total Cryptosporidium removal an inactivation is at least 5.5-log.

(b) (i) Filtered systems must use one or more of the treatment and management options listed in R309-215-15(14), termed the microbial toolbox, to comply with the additional Cryptosporidium treatment required in paragraph (a) of this section.

(ii) Systems classified in Bin 3 and Bin 4 must achieve at least 1-log of the additional Cryptosporidium treatment required under paragraph (a) of this section using either one or a combination of the following: bag filters, bank filtration, cartridge filters, chlorine dioxide, membranes, ozone, or UV, as described in R309-215-15(15) through R309-215-15(19).

(c) Failure by a system in any month to achieve treatment credit by meeting criteria in R309-215-15(15) through R309-215-15(19) for microbial toolbox options that is at least equal to the level of treatment required in paragraph (a) of this section is a violation of the treatment technique requirement.

(d) If the Executive Secretary determines during a sanitary survey or an equivalent source water assessment that after a system completed the monitoring conducted under R309-215-15(2)(a) or R309-215-15(2)(b), significant changes

occurred in the system's watershed that could lead to increased contamination of the source water by *Cryptosporidium*, the system must take actions specified by the Executive Secretary to address the contamination. These actions may include additional source water monitoring and/or implementing microbial toolbox options listed in R309-215-15(14).

(13) Schedule for compliance with *Cryptosporidium* treatment requirements.

- (a) Following initial bin classification under R309-215-15(11)(c), filtered systems must provide the level of treatment for *Cryptosporidium* required under R309-215-15(12) according to the schedule in paragraph (c) of this section.
- (b) *Cryptosporidium* treatment compliance dates.
 - (i) Systems that serve at least 100,000 people must comply with *Cryptosporidium* treatment requirements no later than April 1, 2012.
 - (ii) Systems that serve from 50,000 to 99,999 people must comply with *Cryptosporidium* treatment requirements no later than October 1, 2012.
 - (iii) Systems that serve from 10,000 to 49,999 people must comply with *Cryptosporidium* treatment requirements no later than October 1, 2013.
 - (iv) Systems that serve less than 10,000 people must comply with *Cryptosporidium* treatment requirements no later than October 1, 2014.
 - (v) The Executive Secretary may allow up to an additional two years for complying with the treatment requirement for systems making capital improvements.
- (c) If the bin classification for a filtered system changes following the second round of source water monitoring, as determined under R309-215-15(11)(d), the system must provide the level of treatment for *Cryptosporidium* required under R309-215-15(12) on a schedule the Executive Secretary approves.

(14) Microbial toolbox options for meeting *Cryptosporidium* treatment requirements.

- (a) Systems receive the treatment credits listed in the table in paragraph (b) of this section by meeting the conditions for microbial toolbox options described in R309-215-15(15) through R309-215-15(19). Systems apply these treatment credits to meet the treatment requirements in R309-215-15(12).

(b) The following sub-section summarizes options in the microbial toolbox and the Cryptosporidium treatment credit with design and implementation criteria.

(i) Source Protection and Management Toolbox Options:

(A) Watershed control program: 0.5-log credit for Executive Secretary-approved program comprising required elements, annual program status report to Executive Secretary, and regular watershed survey. Specific criteria are in R309-215-15(15) (a).

(B) Alternative source/intake management: No prescribed credit. Systems may conduct simultaneous monitoring for treatment bin classification at alternative intake locations or under alternative intake management strategies. Specific criteria are in R309-215-15(15) (b).

(ii) Pre Filtration Toolbox Options:

(A) Presedimentation basin with coagulation: 0.5-log credit during any month that presedimentation basins achieve a monthly mean reduction of 0.5-log or greater in turbidity or alternative Executive Secretary-approved performance criteria. To be eligible, basins must be operated continuously with coagulant addition and all plant flow must pass through basins. Specific criteria are in R309-215-15(16) (a).

(B) Two-stage lime softening: 0.5-log credit for two-stage softening where chemical addition and hardness precipitation occur in both stages. All plant flow must pass through both stages. Single-stage softening is credited as equivalent to conventional treatment. Specific criteria are in R309-215-15(16) (b).

(C) Bank filtration: 0.5-log credit for 25-foot setback; 1.0-log credit for 50-foot setback; aquifer must be unconsolidated sand containing at least 10 percent fines; average turbidity in wells must be less than 1 NTU. Systems using wells followed by filtration when conducting source water monitoring must sample the well to determine bin classification and are not eligible for additional credit. Specific criteria are in R309-215-15(16) (c).

(iii) Treatment Performance Toolbox Options:

(A) Combined filter performance: 0.5-log credit for combined filter effluent turbidity less than or equal to 0.15 NTU in at least 95 percent of measurements each month. Specific criteria are in R309-215-15(17) (a).

(B) Individual filter performance: 0.5-log credit (in addition to 0.5-log combined filter performance credit) if individual filter effluent turbidity is less than or equal to 0.15 NTU in at least 95 percent of samples each month in each filter and is never greater than 0.3 NTU in two consecutive measurements in any filter. Specific criteria are in R309-215-15(17) (b).

(C) Demonstration of performance: Credit awarded to unit process or treatment train based on a demonstration to the Executive Secretary with a Executive Secretary-approved protocol. Specific criteria are in R309-215-15(17) (c).

(iv) Additional Filtration Toolbox Options:

(A) Bag or cartridge filters (individual filters): Up to 2-log credit based on the removal efficiency demonstrated during challenge testing with a 1.0-log factor of safety. Specific criteria are in R309-215-15(18) (a).

(B) Bag or cartridge filters (in series): Up to 2.5-log credit based on the removal efficiency demonstrated during challenge testing with a 0.5-log factor of safety. Specific criteria are in R309-215-15(18) (a).

(C) Membrane filtration: Log credit equivalent to removal efficiency demonstrated in challenge test for device if supported by direct integrity testing. Specific criteria are in R309-215-15(18) (b).

(D) Second stage filtration: 0.5-log credit for second separate granular media filtration stage if treatment train includes coagulation prior to first filter. Specific criteria are in R309-215-15(18) (c).

(E) Slow sand filters: 2.5-log credit as a secondary filtration step; 3.0-log credit as a primary filtration process. No prior chlorination for either option. Specific criteria are in R309-215-15(18) (d).

(v) Inactivation Toolbox Options:

(A) Chlorine dioxide: Log credit based on measured CT in relation to CT table. Specific criteria in R309-215-15(19) (b).

(B) Ozone: Log credit based on measured CT in relation to CT table. Specific criteria in R309-215-15(19) (b).

(C) UV: Log credit based on validated UV dose in relation to UV dose table; reactor validation testing required to establish UV dose and associated operating conditions. Specific criteria in R309-215-15(19) (d).

(15) Source toolbox components.

(a) Watershed control program. Systems receive 0.5-log *Cryptosporidium* treatment credit for implementing a watershed control program that meets the requirements of this section.

(i) Systems that intend to apply for the watershed control program credit must notify the Executive Secretary of this intent no later than two years prior to the treatment compliance date applicable to the system in R309-215-15(13).

(ii) Systems must submit to the Executive Secretary a proposed watershed control plan no later than one year before the applicable treatment compliance date in R309-215-15(13). The Executive Secretary must approve the watershed control plan for the system to receive watershed control program treatment credit. The watershed control plan must include the elements in paragraphs (a)(ii)(A) through (D) of this section.

(A) Identification of an "area of influence" outside of which the likelihood of *Cryptosporidium* or fecal contamination affecting the treatment plant intake is not significant. This is the area to be evaluated in future watershed surveys under paragraph (a)(v)(B) of this section.

(B) Identification of both potential and actual sources of *Cryptosporidium* contamination and an assessment of the relative impact of these sources on the system's source water quality.

(C) An analysis of the effectiveness and feasibility of control measures that could reduce *Cryptosporidium* loading from sources of contamination to the system's source water.

(D) A statement of goals and specific actions the system will undertake to reduce source water *Cryptosporidium* levels. The plan must explain how the actions are expected to contribute to specific goals, identify watershed partners and their roles, identify resource requirements and commitments, and include a schedule for plan implementation with deadlines for completing specific actions identified in the plan.

(iii) Systems with existing watershed control programs (i.e., programs in place on January 5, 2006) are eligible to seek this credit. Their watershed control plans must meet the criteria in paragraph (a)(ii) of this section and must specify ongoing and future actions that will reduce source water *Cryptosporidium* levels.

(iv) If the Executive Secretary does not respond to a system regarding approval of a watershed control plan submitted under this section and the system meets the other requirements of this section, the watershed control program will be considered approved and 0.5 log *Cryptosporidium* treatment credit will be awarded unless and until the Executive Secretary subsequently withdraws such approval.

(v) Systems must complete the actions in paragraphs (a)(v)(A) through (C) of this section to maintain the 0.5-log credit.

(A) Submit an annual watershed control program status report to the Executive Secretary. The annual watershed control program status report must describe the system's implementation of the approved plan and assess the adequacy of the plan to meet its goals. It must explain how the system is addressing any shortcomings in plan implementation, including those previously identified by the Executive Secretary or as the result of the watershed survey conducted under paragraph (a)(v)(B) of this section. It must also describe any significant changes that have occurred in the watershed since the last watershed sanitary survey. If a system determines during implementation that making a significant change to its approved watershed control program is necessary, the system must notify the Executive Secretary prior to making any such changes. If any change is likely to reduce the level of source water protection, the system must also list in its notification the actions the system will take to mitigate this effect.

(B) Undergo a watershed sanitary survey every three years for community water systems and every five years for non-community water systems and submit the survey report to the Executive Secretary. The survey must be conducted according to State guidelines and by persons the Executive Secretary approves.

(I) The watershed sanitary survey must meet the following criteria: encompass the region identified in the Executive Secretary-approved watershed control plan as the area of influence; assess the implementation of actions to reduce source water *Cryptosporidium* levels; and identify any significant new sources of *Cryptosporidium*.

(II) If the Executive Secretary determines that significant changes may have occurred in the watershed since the previous watershed sanitary survey, systems must undergo another watershed sanitary survey by a date the Executive Secretary requires, which may be earlier than the regular date in paragraph (a)(v)(B) of this section.

(C) The system must make the watershed control plan, annual status reports, and watershed sanitary survey reports available to the public upon request. These documents must be in a plain language style and include criteria by which to evaluate the success of the program in achieving plan goals. The Executive Secretary may approve systems to withhold from the public portions of the annual status report, watershed control plan, and watershed sanitary survey based on water supply security considerations.

(vi) If the Executive Secretary determines that a system is not carrying out the approved watershed control plan, the Executive Secretary may withdraw the watershed control program treatment credit.

(b) Alternative source. (i) A system may conduct source water monitoring that reflects a different intake location (either in the same source or for an alternate source) or a different procedure for the timing or level of withdrawal from the source (alternative source monitoring). If the Executive Secretary approves, a system may determine its bin classification under R309-215-15(11) based on the alternative source monitoring results.

(ii) If systems conduct alternative source monitoring under paragraph (b)(i) of this section, systems must also monitor their current plant intake concurrently as described in R309-215-15(2).

(iii) Alternative source monitoring under paragraph (b)(i) of this section must meet the requirements for source monitoring to determine bin classification, as described in R309-215-15(2) through R309-215-15(7). Systems must report the alternative source monitoring results to the Executive Secretary, along with supporting information documenting the operating conditions under which the samples were collected.

(iv) If a system determines its bin classification under R309-215-15(11) using alternative source monitoring results that reflect a different intake location or a different procedure for managing the timing or level of withdrawal from the source, the system must relocate the intake or permanently adopt the withdrawal procedure, as applicable, no later than the applicable treatment compliance date in R309-215-15(13).

(16) Pre-filtration treatment toolbox components.

(a) Presedimentation. Systems receive 0.5-log *Cryptosporidium* treatment credit for a presedimentation basin during any month the process meets the criteria in this paragraph.

(i) The presedimentation basin must be in continuous operation and must treat the entire plant flow taken from a surface water or GWUDI source.

(ii) The system must continuously add a coagulant to the presedimentation basin.

(iii) The presedimentation basin must achieve the performance criteria in paragraph (iii)(A) or (B) of this section.

(A) Demonstrates at least 0.5-log mean reduction of influent turbidity. This reduction must be determined using daily turbidity measurements in the presedimentation process influent and effluent and must be calculated as follows: $\log_{10}(\text{monthly mean of daily influent turbidity}) - \log_{10}(\text{monthly mean of daily effluent turbidity})$.

(B) Complies with Executive Secretary-approved performance criteria that demonstrate at least 0.5-log mean removal of micron-sized particulate material through the presedimentation process.

(b) Two-stage lime softening. Systems receive an additional 0.5-log *Cryptosporidium* treatment credit for a two-stage lime softening plant if chemical addition and hardness precipitation occur in two separate and sequential softening stages prior to filtration. Both softening stages must treat the entire plant flow taken from a surface water or GWUDI source.

(c) Bank filtration. Systems receive *Cryptosporidium* treatment credit for bank filtration that serves as pretreatment to a filtration plant by meeting the criteria in this paragraph. Systems using bank filtration when they begin source water monitoring under R309-215-15(2)(a) must collect samples as described in R309-215-15(4)(d) and are not eligible for this credit.

(i) Wells with a ground water flow path of at least 25 feet receive 0.5-log treatment credit; wells with a ground water flow path of at least 50 feet receive 1.0-log treatment credit. The ground water flow path must be determined as specified in paragraph (c)(iv) of this section.

(ii) Only wells in granular aquifers are eligible for treatment credit. Granular aquifers are those comprised of sand, clay, silt, rock fragments, pebbles or larger particles, and minor cement. A system must characterize

the aquifer at the well site to determine aquifer properties. Systems must extract a core from the aquifer and demonstrate that in at least 90 percent of the core length, grains less than 1.0 mm in diameter constitute at least 10 percent of the core material.

(iii) Only horizontal and vertical wells are eligible for treatment credit.

(iv) For vertical wells, the ground water flow path is the measured distance from the edge of the surface water body under high flow conditions (determined by the 100 year floodplain elevation boundary or by the floodway, as defined in Federal Emergency Management Agency flood hazard maps) to the well screen. For horizontal wells, the ground water flow path is the measured distance from the bed of the river under normal flow conditions to the closest horizontal well lateral screen.

(v) Systems must monitor each wellhead for turbidity at least once every four hours while the bank filtration process is in operation. If monthly average turbidity levels, based on daily maximum values in the well, exceed 1 NTU, the system must report this result to the Executive Secretary and conduct an assessment within 30 days to determine the cause of the high turbidity levels in the well. If the Executive Secretary determines that microbial removal has been compromised, the Executive Secretary may revoke treatment credit until the system implements corrective actions approved by the Executive Secretary to remediate the problem.

(vi) Springs and infiltration galleries are not eligible for treatment credit under this section, but are eligible for credit under R309-215-15(17)(c).

(vii) Bank filtration demonstration of performance. The Executive Secretary may approve *Cryptosporidium* treatment credit for bank filtration based on a demonstration of performance study that meets the criteria in this paragraph. This treatment credit may be greater than 1.0-log and may be awarded to bank filtration that does not meet the criteria in paragraphs (c)(i)-(v) of this section.

(A) The study must follow a Executive Secretary-approved protocol and must involve the collection of data on the removal of *Cryptosporidium* or a surrogate for *Cryptosporidium* and related hydrogeologic and water quality parameters during the full range of operating conditions.

(B) The study must include sampling both from the production well(s) and from monitoring wells that are screened and located along the shortest flow path between the surface water source and the production well(s).

(17) Treatment performance toolbox components.

(a) Combined filter performance. Systems using conventional filtration treatment or direct filtration treatment receive an additional 0.5-log Cryptosporidium treatment credit during any month the system meets the criteria in this paragraph. Combined filter effluent (CFE) turbidity must be less than or equal to 0.15 NTU in at least 95 percent of the measurements. Turbidity must be measured as described in R309-200-4(3) and (4).

(b) Individual filter performance. Systems using conventional filtration treatment or direct filtration treatment receive 0.5-log Cryptosporidium treatment credit, which can be in addition to the 0.5-log credit under paragraph (a) of this section, during any month the system meets the criteria in this paragraph. Compliance with these criteria must be based on individual filter turbidity monitoring as described in R309-215-9(4) or (5), as applicable.

(i) The filtered water turbidity for each individual filter must be less than or equal to 0.15 NTU in at least 95 percent of the measurements recorded each month.

(ii) No individual filter may have a measured turbidity greater than 0.3 NTU in two consecutive measurements taken 15 minutes apart.

(iii) Any system that has received treatment credit for individual filter performance and fails to meet the requirements of paragraph (b)(i) or (ii) of this section during any month does not receive a treatment technique violation under R309-215-15(12)(c) if the Executive Secretary determines the following:

(A) The failure was due to unusual and short-term circumstances that could not reasonably be prevented through optimizing treatment plant design, operation, and maintenance.

(B) The system has experienced no more than two such failures in any calendar year.

(c) Demonstration of performance. The Executive Secretary may approve Cryptosporidium treatment credit for drinking water treatment processes based on a demonstration of performance study that meets the criteria in this paragraph. This treatment credit may be greater than or less than the prescribed treatment credits in R309-215-15(12) or R309-215-15(16) through R309-215-15(19) and may be awarded to treatment processes that do not meet the criteria for the prescribed credits.

(i) Systems cannot receive the prescribed treatment credit for any toolbox box option in R309-215-15(16) through R309-215-15(19) if that toolbox option is included in a demonstration of performance study for which treatment credit is awarded under this paragraph.

(ii) The demonstration of performance study must follow a Executive Secretary-approved protocol and must demonstrate the level of Cryptosporidium reduction the treatment process will achieve under the full range of expected operating conditions for the system.

(iii) Approval by the Executive Secretary must be in writing and may include monitoring and treatment performance criteria that the system must demonstrate and report on an ongoing basis to remain eligible for the treatment credit. The Executive Secretary may designate such criteria where necessary to verify that the conditions under which the demonstration of performance credit was approved are maintained during routine operation.

(18) Additional filtration toolbox components.

(a) Bag and cartridge filters. Systems receive Cryptosporidium treatment credit of up to 2.0-log for individual bag or cartridge filters and up to 2.5-log for bag or cartridge filters operated in series by meeting the criteria in paragraphs (a)(i) through (x) of this section. To be eligible for this credit, systems must report the results of challenge testing that meets the requirements of paragraphs (a)(ii) through (ix) of this section to the Executive Secretary. The filters must treat the entire plant flow taken from a surface water source.

(i) The Cryptosporidium treatment credit awarded to bag or cartridge filters must be based on the removal efficiency demonstrated during challenge testing that is conducted according to the criteria in paragraphs (a)(ii) through (a)(ix) of this section. A factor of safety equal to 1-log for individual bag or cartridge filters and 0.5-log for bag or cartridge filters in series must be applied to challenge testing results to determine removal credit. Systems may use results from challenge testing conducted prior to January 5, 2006 if the prior testing was consistent with the criteria specified in paragraphs (a)(ii) through (ix) of this section.

(ii) Challenge testing must be performed on full-scale bag or cartridge filters, and the associated filter housing or pressure vessel, that are identical in material and construction to the filters and housings the system will use for removal of Cryptosporidium. Bag or cartridge filters must be challenge tested in the same configuration that the system will use, either as individual filters or as a series configuration of filters.

(iii) Challenge testing must be conducted using *Cryptosporidium* or a surrogate that is removed no more efficiently than *Cryptosporidium*. The microorganism or surrogate used during challenge testing is referred to as the challenge particulate. The concentration of the challenge particulate must be determined using a method capable of discreetly quantifying the specific microorganism or surrogate used in the test; gross measurements such as turbidity may not be used.

(iv) The maximum feed water concentration that can be used during a challenge test must be based on the detection limit of the challenge particulate in the filtrate (i.e., filtrate detection limit) and must be calculated using the following equation: $\text{Maximum Feed Concentration} = 1 \times 10^4 \times (\text{Filtrate Detection Limit})$.

(v) Challenge testing must be conducted at the maximum design flow rate for the filter as specified by the manufacturer.

(vi) Each filter evaluated must be tested for a duration sufficient to reach 100 percent of the terminal pressure drop, which establishes the maximum pressure drop under which the filter may be used to comply with the requirements of this subpart.

(vii) Removal efficiency of a filter must be determined from the results of the challenge test and expressed in terms of log removal values using the following equation: $\text{LRV} = \text{LOG}_{10}(\text{Cf}) - \text{LOG}_{10}(\text{Cp})$ Where: LRV = log removal value demonstrated during challenge testing; Cf = the feed concentration measured during the challenge test; and Cp = the filtrate concentration measured during the challenge test. In applying this equation, the same units must be used for the feed and filtrate concentrations. If the challenge particulate is not detected in the filtrate, then the term Cp must be set equal to the detection limit.

(viii) Each filter tested must be challenged with the challenge particulate during three periods over the filtration cycle: within two hours of start-up of a new filter; when the pressure drop is between 45 and 55 percent of the terminal pressure drop; and at the end of the cycle after the pressure drop has reached 100 percent of the terminal pressure drop. An LRV must be calculated for each of these challenge periods for each filter tested. The LRV for the filter (LRV_{filter}) must be assigned the value of the minimum LRV observed during the three challenge periods for that filter.

(ix) If fewer than 20 filters are tested, the overall removal efficiency for the filter product line must be set equal to the lowest LRV_{filter} among the filters tested. If 20 or more filters are tested, the overall removal efficiency for the filter product line must be set equal to the 10th percentile of the set of LRV_{filter} values for the various filters tested. The

percentile is defined by $(i/(n+1))$ where i is the rank of n individual data points ordered lowest to highest. If necessary, the 10th percentile may be calculated using linear interpolation.

(x) If a previously tested filter is modified in a manner that could change the removal efficiency of the filter product line, challenge testing to demonstrate the removal efficiency of the modified filter must be conducted and submitted to the Executive Secretary.

(b) Membrane filtration.

(i) Systems receive *Cryptosporidium* treatment credit for membrane filtration that meets the criteria of this paragraph. Membrane cartridge filters that meet the definition of membrane filtration in R309-110 are eligible for this credit. The level of treatment credit a system receives is equal to the lower of the values determined under paragraph (b)(i)(A) and (B) of this section.

(A) The removal efficiency demonstrated during challenge testing conducted under the conditions in paragraph (b)(ii) of this section.

(B) The maximum removal efficiency that can be verified through direct integrity testing used with the membrane filtration process under the conditions in paragraph (b)(iii) of this section.

(ii) Challenge Testing. The membrane used by the system must undergo challenge testing to evaluate removal efficiency, and the system must report the results of challenge testing to the Executive Secretary. Challenge testing must be conducted according to the criteria in paragraphs (b)(ii)(A) through (G) of this section. Systems may use data from challenge testing conducted prior to January 5, 2006 if the prior testing was consistent with the criteria in paragraphs (b)(ii)(A) through (G) of this section.

(A) Challenge testing must be conducted on either a full-scale membrane module, identical in material and construction to the membrane modules used in the system's treatment facility, or a smaller-scale membrane module, identical in material and similar in construction to the full-scale module. A module is defined as the smallest component of a membrane unit in which a specific membrane surface area is housed in a device with a filtrate outlet structure.

(B) Challenge testing must be conducted using *Cryptosporidium* oocysts or a surrogate that is removed no more efficiently than *Cryptosporidium* oocysts. The organism or surrogate used during

challenge testing is referred to as the challenge particulate. The concentration of the challenge particulate, in both the feed and filtrate water, must be determined using a method capable of discretely quantifying the specific challenge particulate used in the test; gross measurements such as turbidity may not be used.

(C) The maximum feed water concentration that can be used during a challenge test is based on the detection limit of the challenge particulate in the filtrate and must be determined according to the following equation: Maximum Feed Concentration = $3.16 \times 10^6 \times (\text{Filtrate Detection Limit})$.

(D) Challenge testing must be conducted under representative hydraulic conditions at the maximum design flux and maximum design process recovery specified by the manufacturer for the membrane module. Flux is defined as the throughput of a pressure driven membrane process expressed as flow per unit of membrane area. Recovery is defined as the volumetric percent of feed water that is converted to filtrate over the course of an operating cycle uninterrupted by events such as chemical cleaning or a solids removal process (i.e., backwashing).

(E) Removal efficiency of a membrane module must be calculated from the challenge test results and expressed as a log removal value according to the following equation: $\text{LRV} = \text{LOG}_{10}(\text{C}_f) - \text{LOG}_{10}(\text{C}_p)$ Where: LRV = log removal value demonstrated during the challenge test; C_f = the feed concentration measured during the challenge test; and C_p = the filtrate concentration measured during the challenge test. Equivalent units must be used for the feed and filtrate concentrations. If the challenge particulate is not detected in the filtrate, the term C_p is set equal to the detection limit for the purpose of calculating the LRV. An LRV must be calculated for each membrane module evaluated during the challenge test.

(F) The removal efficiency of a membrane filtration process demonstrated during challenge testing must be expressed as a log removal value (LRVC-Test). If fewer than 20 modules are tested, then LRVC-Test is equal to the lowest of the representative LRVs among the modules tested. If 20 or more modules are tested, then LRVC-Test is equal to the 10th percentile of the representative LRVs among the modules tested. The percentile is defined by $(i/(n+1))$ where i is the rank of n individual data points ordered lowest to highest. If necessary, the 10th percentile may be calculated using linear interpolation.

(G) The challenge test must establish a quality control release value (QCRV) for a non-destructive performance test that demonstrates the Cryptosporidium removal capability of the membrane filtration module. This performance test must be applied to each production membrane module used by the system that was not directly challenge tested in order to verify Cryptosporidium removal capability. Production modules that do not meet the established QCRV are not eligible for the treatment credit demonstrated during the challenge test.

(H) If a previously tested membrane is modified in a manner that could change the removal efficiency of the membrane or the applicability of the non-destructive performance test and associated QCRV, additional challenge testing to demonstrate the removal efficiency of, and determine a new QCRV for, the modified membrane must be conducted and submitted to the Executive Secretary.

(iii) Direct integrity testing. Systems must conduct direct integrity testing in a manner that demonstrates a removal efficiency equal to or greater than the removal credit awarded to the membrane filtration process and meets the requirements described in paragraphs (b)(iii)(A) through (F) of this section. A direct integrity test is defined as a physical test applied to a membrane unit in order to identify and isolate integrity breaches (i.e., one or more leaks that could result in contamination of the filtrate).

(A) The direct integrity test must be independently applied to each membrane unit in service. A membrane unit is defined as a group of membrane modules that share common valving that allows the unit to be isolated from the rest of the system for the purpose of integrity testing or other maintenance.

(B) The direct integrity method must have a resolution of 3 micrometers or less, where resolution is defined as the size of the smallest integrity breach that contributes to a response from the direct integrity test.

(C) The direct integrity test must have a sensitivity sufficient to verify the log treatment credit awarded to the membrane filtration process by the Executive Secretary, where sensitivity is defined as the maximum log removal value that can be reliably verified by a direct integrity test. Sensitivity must be determined using the approach in either paragraph (b)(iii)(C)(I) or (II) of this section as applicable to the type of direct integrity test the system uses.

(I) For direct integrity tests that use an applied pressure or vacuum, the direct integrity test sensitivity must be calculated according to the following equation: $LRVDIT = \text{LOG}_{10} (Q_p / (VCF \times Q_{\text{breach}}))$ Where: LRVDIT = the sensitivity of the direct integrity test; Q_p = total design filtrate flow from the membrane unit; Q_{breach} = flow of water from an integrity breach associated with the smallest integrity test response that can be reliably measured, and VCF = volumetric concentration factor. The volumetric concentration factor is the ratio of the suspended solids concentration on the high pressure side of the membrane relative to that in the feed water.

(II) For direct integrity tests that use a particulate or molecular marker, the direct integrity test sensitivity must be calculated according to the following equation: $LRVDIT = \text{LOG}_{10}(C_f) - \text{LOG}_{10}(C_p)$ Where: LRVDIT = the sensitivity of the direct integrity test; C_f = the typical feed concentration of the marker used in the test; and C_p = the filtrate concentration of the marker from an integral membrane unit.

(D) Systems must establish a control limit within the sensitivity limits of the direct integrity test that is indicative of an integral membrane unit capable of meeting the removal credit awarded by the Executive Secretary.

(E) If the result of a direct integrity test exceeds the control limit established under paragraph (b)(iii)(D) of this section, the system must remove the membrane unit from service. Systems must conduct a direct integrity test to verify any repairs, and may return the membrane unit to service only if the direct integrity test is within the established control limit.

(F) Systems must conduct direct integrity testing on each membrane unit at a frequency of not less than once each day that the membrane unit is in operation. The Executive Secretary may approve less frequent testing, based on demonstrated process reliability, the use of multiple barriers effective for *Cryptosporidium*, or reliable process safeguards.

(iv) Indirect integrity monitoring. Systems must conduct continuous indirect integrity monitoring on each membrane unit according to the criteria in paragraphs (b)(iv)(A) through (E) of this section. Indirect integrity monitoring is defined as monitoring some aspect of filtrate water quality that is indicative of the removal of particulate matter. A system

that implements continuous direct integrity testing of membrane units in accordance with the criteria in paragraphs (b)(iii)(A) through (E) of this section is not subject to the requirements for continuous indirect integrity monitoring. Systems must submit a monthly report to the Executive Secretary summarizing all continuous indirect integrity monitoring results triggering direct integrity testing and the corrective action that was taken in each case.

(A) Unless the Executive Secretary approves an alternative parameter, continuous indirect integrity monitoring must include continuous filtrate turbidity monitoring.

(B) Continuous monitoring must be conducted at a frequency of no less than once every 15 minutes.

(C) Continuous monitoring must be separately conducted on each membrane unit.

(D) If indirect integrity monitoring includes turbidity and if the filtrate turbidity readings are above 0.15 NTU for a period greater than 15 minutes (i.e., two consecutive 15-minute readings above 0.15 NTU), direct integrity testing must immediately be performed on the associated membrane unit as specified in paragraphs (b)(iii)(A) through (E) of this section.

(E) If indirect integrity monitoring includes a Executive Secretary-approved alternative parameter and if the alternative parameter exceeds a Executive Secretary-approved control limit for a period greater than 15 minutes, direct integrity testing must immediately be performed on the associated membrane units as specified in paragraphs (b)(iii)(A) through (E) of this section.

(c) Second stage filtration. Systems receive 0.5-log *Cryptosporidium* treatment credit for a separate second stage of filtration that consists of sand, dual media, GAC, or other fine grain media following granular media filtration if the Executive Secretary approves. To be eligible for this credit, the first stage of filtration must be preceded by a coagulation step and both filtration stages must treat the entire plant flow taken from a surface water or GWUDI source. A cap, such as GAC, on a single stage of filtration is not eligible for this credit. The Executive Secretary must approve the treatment credit based on an assessment of the design characteristics of the filtration process.

(d) Slow sand filtration (as secondary filter). Systems are eligible to receive 2.5-log *Cryptosporidium* treatment credit for a slow sand filtration process that follows a separate stage of filtration if both filtration stages treat entire plant flow taken from a surface water or GWUDI source and no disinfectant residual is

present in the influent water to the slow sand filtration process. The Executive Secretary must approve the treatment credit based on an assessment of the design characteristics of the filtration process. This paragraph does not apply to treatment credit awarded to slow sand filtration used as a primary filtration process.

(19) Inactivation toolbox components.

(a) Calculation of CT values. (i) CT is the product of the disinfectant contact time (T, in minutes) and disinfectant concentration (C, in milligrams per liter). Systems with treatment credit for chlorine dioxide or ozone under paragraph (b) or (c) of this section must calculate CT at least once each day, with both C and T measured during peak hourly flow as specified in R309-200-4(3) and (4).

(ii) Systems with several disinfection segments in sequence may calculate CT for each segment, where a disinfection segment is defined as a treatment unit process with a measurable disinfectant residual level and a liquid volume. Under this approach, systems must add the Cryptosporidium CT values in each segment to determine the total CT for the treatment plant.

(b) CT values for chlorine dioxide and ozone. (i) Systems receive the Cryptosporidium treatment credit listed in this paragraph by meeting the corresponding chlorine dioxide CT value for the applicable water temperature, as described in paragraph (a) of this section.

(i) CT values ((MG)(MIN)/L) for Cryptosporidium inactivation by Chlorine Dioxide listed by the log credit with inactivation listed by water temperature in degrees Celsius.

(A) 0.25 Log Credit:

(I) less than or equal to 0.5 degrees: 159;

(II) 1 degree: 153;

(III) 2 degrees: 140;

(IV) 3 degrees: 128;

(V) 5 degrees: 107;

(VI) 7 degrees: 90;

(VII) 10 degrees: 69;

- (VIII) 15 degrees: 45;
- (IX) 20 degrees: 29;
- (X) 25 degrees: 19; and
- (XI) 30 degrees: 12.

(B) 0.5 Log Credit:

- (I) less than or equal to 0.5 degrees: 319;
- (II) 1 degree: 305;
- (III) 2 degrees: 279;
- (IV) 3 degrees: 256;
- (V) 5 degrees: 214;
- (VI) 7 degrees: 180;
- (VII) 10 degrees: 138;
- (VIII) 15 degrees: 89;
- (IX) 20 degrees: 58;
- (X) 25 degrees: 38; and
- (XI) 30 degrees: 24.

(C) 1.0 Log Credit:

- (I) less than or equal to 0.5 degrees: 637;
- (II) 1 degree: 610;
- (III) 2 degrees: 558;
- (IV) 3 degrees: 511;
- (V) 5 degrees: 429;
- (VI) 7 degrees: 360;

- (VII) 10 degrees: 277;
- (VIII) 15 degrees: 179;
- (IX) 20 degrees: 116;
- (X) 25 degrees: 75; and
- (XI) 30 degrees: 49.

(D) 1.5 Log Credit:

- (I) less than or equal to 0.5 degrees: 956;
- (II) 1 degree: 915;
- (III) 2 degrees: 838;
- (IV) 3 degrees: 767;
- (V) 5 degrees: 643;
- (VI) 7 degrees: 539;
- (VII) 10 degrees: 415;
- (VIII) 15 degrees: 268;
- (IX) 20 degrees: 174;
- (X) 25 degrees: 113; and
- (XI) 30 degrees: 73.

(E) 2.0 Log Credit:

- (I) less than or equal to 0.5 degrees: 1275;
- (II) 1 degree: 1220;
- (III) 2 degrees: 1117;
- (IV) 3 degrees: 1023;
- (V) 5 degrees: 858;

- (VI) 7 degrees: 719;
- (VII) 10 degrees: 553;
- (VIII) 15 degrees: 357;
- (IX) 20 degrees: 232;
- (X) 25 degrees: 150; and
- (XI) 30 degrees: 98.

(F) 2.5 Log Credit:

- (I) less than or equal to 0.5 degrees: 1594;
- (II) 1 degree: 1525;
- (III) 2 degrees: 1396;
- (IV) 3 degrees: 1278;
- (V) 5 degrees: 1072;
- (VI) 7 degrees: 899;
- (VII) 10 degrees: 691;
- (VIII) 15 degrees: 447;
- (IX) 20 degrees: 289;
- (X) 25 degrees: 188; and
- (XI) 30 degrees: 122.

(G) 3.0 Log Credit:

- (I) less than or equal to 0.5 degrees: 1912;
- (II) 1 degree: 1830;
- (III) 2 degrees: 1675;
- (IV) 3 degrees: 1534;

- (V) 5 degrees: 1286;
- (VI) 7 degrees: 1079;
- (VII) 10 degrees: 830;
- (VIII) 15 degrees: 536;
- (IX) 20 degrees: 347;
- (X) 25 degrees: 226; and
- (XI) 30 degrees: 147.

(F) Systems may use this equation to determine log credit between the indicated values above: $\text{Log credit} = (0.001506 \times (1.09116)^{\text{Temp}}) \times \text{CT}$.

(ii) Systems receive the Cryptosporidium treatment credit listed in this paragraph by meeting the corresponding ozone CT values for the applicable water temperature, as described in paragraph (a) of this section. CT values ((MG)(MIN)/L) for Cryptosporidium inactivation by Ozone listed by the log credit with inactivation listed by water temperature in degrees Celsius.

(A) 0.25 Log Credit:

- (I) less than or equal to 0.5 degrees: 6.0;
- (II) 1 degree: 5.8;
- (III) 2 degrees: 5.2;
- (IV) 3 degrees: 4.8;
- (V) 5 degrees: 4.0;
- (VI) 7 degrees: 3.3;
- (VII) 10 degrees: 2.5;
- (VIII) 15 degrees: 1.6;
- (IX) 20 degrees: 1.0;

(X) 25 degrees: 0.6; and

(XI) 30 degrees: 0.39.

(B) 0.5 Log Credit:

(I) less than or equal to 0.5 degrees: 12;

(II) 1 degree: 12;

(III) 2 degrees: 10;

(IV) 3 degrees: 9.5;

(V) 5 degrees: 7.9;

(VI) 7 degrees: 6.5;

(VII) 10 degrees: 4.9;

(VIII) 15 degrees: 3.1;

(IX) 20 degrees: 2.0;

(X) 25 degrees: 1.2; and

(XI) 30 degrees: 0.78.

(C) 1.0 Log Credit:

(I) less than or equal to 0.5 degrees: 24;

(II) 1 degree: 23;

(III) 2 degrees: 21;

(IV) 3 degrees: 19;

(V) 5 degrees: 16;

(VI) 7 degrees: 13;

(VII) 10 degrees: 9.9;

(VIII) 15 degrees: 6.2;

(IX) 20 degrees: 3.9;

(X) 25 degrees: 2.5; and

(XI) 30 degrees: 1.6.

(D) 1.5 Log Credit:

(I) less than or equal to 0.5 degrees: 36;

(II) 1 degree: 35;

(III) 2 degrees: 31;

(IV) 3 degrees: 29;

(V) 5 degrees: 24;

(VI) 7 degrees: 20;

(VII) 10 degrees: 15;

(VIII) 15 degrees: 9.3;

(IX) 20 degrees: 5.9;

(X) 25 degrees: 3.7; and

(XI) 30 degrees: 2.4.

(E) 2.0 Log Credit:

(I) less than or equal to 0.5 degrees: 48;

(II) 1 degree: 46;

(III) 2 degrees: 42;

(IV) 3 degrees: 38;

(V) 5 degrees: 32;

(VI) 7 degrees: 26;

(VII) 10 degrees: 20;

- (VIII) 15 degrees: 12;
- (IX) 20 degrees: 7.8;
- (X) 25 degrees: 4.9; and
- (XI) 30 degrees: 3.1.

(F) 2.5 Log Credit:

- (I) less than or equal to 0.5 degrees: 60;
- (II) 1 degree: 58;
- (III) 2 degrees: 52;
- (IV) 3 degrees: 48;
- (V) 5 degrees: 40;
- (VI) 7 degrees: 33;
- (VII) 10 degrees: 25;
- (VIII) 15 degrees: 16;
- (IX) 20 degrees: 9.8;
- (X) 25 degrees: 6.2; and
- (XI) 30 degrees: 3.9.

(G) 3.0 Log Credit:

- (I) less than or equal to 0.5 degrees: 72;
- (II) 1 degree: 69;
- (III) 2 degrees: 63;
- (IV) 3 degrees: 57;
- (V) 5 degrees: 47;
- (VI) 7 degrees: 39;

(VII) 10 degrees: 30;

(VIII) 15 degrees: 19;

(IX) 20 degrees: 12;

(X) 25 degrees: 7.4; and

(XI) 30 degrees: 4.7.

(F) Systems may use this equation to determine log credit between the indicated values: $\text{Log credit} = (0.0397 \times (1.09757)^{\text{Temp}}) \times \text{CT}$.

(c) Site-specific study. The Executive Secretary may approve alternative chlorine dioxide or ozone CT values to those listed in paragraph (b) above on a site-specific basis. The Executive Secretary must base this approval on a site-specific study a system conducts that follows a protocol approved by the Executive Secretary.

(d) Ultraviolet light. Systems receive Cryptosporidium, Giardia lamblia, and virus treatment credits for ultraviolet (UV) light reactors by achieving the corresponding UV dose values shown in paragraph (d)(i) of this section. Systems must validate and monitor UV reactors as described in paragraph (d)(ii) and (iii) of this section to demonstrate that they are achieving a particular UV dose value for treatment credit.

(i) UV dose table. The treatment credits listed in Table 215-5 are for UV light at a wavelength of 254 nm as produced by a low pressure mercury vapor lamp. To receive treatment credit for other lamp types, systems must demonstrate an equivalent germicidal dose through reactor validation testing, as described in paragraph (d)(ii). The UV dose values in Table 215-5 are applicable only to post-filter applications of UV in filtered systems.

TABLE 215-5			
UV Dose Table for Cryptosporidium,			
Giardia lamblia, and Virus Inactivation Credit			
Log credit	Cryptosporidium UV dose (mJ/cm2)	Giardia lamblia UV dose (mJ/cm2)	Virus UV dose (mJ/cm2)
0.5	1.6	1.5	39
1.0	2.5	2.1	58
1.5	3.9	3.0	79
2.0	5.8	5.2	100
2.5	8.5	7.7	121

3.0	12	11	143
3.5	15	15	163
4.0	22	22	186

(ii) Reactor validation testing. Systems must use UV reactors that have undergone validation testing to determine the operating conditions under which the reactor delivers the UV dose required in paragraph (d)(i) of this section (i.e., validated operating conditions). These operating conditions must include flow rate, UV intensity as measured by a UV sensor, and UV lamp status.

(A) When determining validated operating conditions, systems must account for the following factors: UV absorbance of the water; lamp fouling and aging; measurement uncertainty of on-line sensors; UV dose distributions arising from the velocity profiles through the reactor; failure of UV lamps or other critical system components; and inlet and outlet piping or channel configurations of the UV reactor.

(B) Validation testing must include the following: Full scale testing of a reactor that conforms uniformly to the UV reactors used by the system and inactivation of a test microorganism whose dose response characteristics have been quantified with a low pressure mercury vapor lamp.

(C) The Executive Secretary may approve an alternative approach to validation testing.

(iii) Reactor monitoring.

(A) Systems must monitor their UV reactors to determine if the reactors are operating within validated conditions, as determined under paragraph (d)(ii) of this section. This monitoring must include UV intensity as measured by a UV sensor, flow rate, lamp status, and other parameters the Executive Secretary designates based on UV reactor operation. Systems must verify the calibration of UV sensors and must recalibrate sensors in accordance with a protocol the Executive Secretary approves.

(B) To receive treatment credit for UV light, systems must treat at least 95 percent of the water delivered to the public during each month by UV reactors operating within validated conditions for the required UV dose, as described in paragraphs (d)(i) and (ii) of this section. Systems must demonstrate compliance with this condition by the monitoring required under paragraph (d)(iii)(A) of this section.

(20) Reporting requirements.

(a) Systems must report sampling schedules under R309-215-15(3) and source water monitoring results under R309-215-15(7) unless they notify the Executive Secretary that they will not conduct source water monitoring due to meeting the criteria of R309-215-15(2)(d).

(b) Filtered systems must report their *Cryptosporidium* bin classification as described in R309-215-15(11).

(c) Systems must report disinfection profiles and benchmarks to the Executive Secretary as described in R309-215-15(9) through R309-215-15(10) prior to making a significant change in disinfection practice.

(d) Systems must report to the Executive Secretary in accordance with the following information on the following schedule for any microbial toolbox options used to comply with treatment requirements under R309-215-15(12). Alternatively, the Executive Secretary may approve a system to certify operation within required parameters for treatment credit rather than reporting monthly operational data for toolbox options.

(i) Watershed control program (WCP).

(A) Notice of intention to develop a new or continue an existing watershed control program no later than two years before the applicable treatment compliance date in R309-215-15(13).

(B) Watershed control plan no later than one year before the applicable treatment compliance date in R309-215-15(13).

(C) Annual watershed control program status report every 12 months, beginning one year after the applicable treatment compliance date in R309-215-15(13).

(D) Watershed sanitary survey report:

(I) For community water systems, every three years beginning three years after the applicable treatment compliance date in R309-215-15(13).

(II) For noncommunity water systems, every five years beginning five years after the applicable treatment compliance date in R309-215-15(13).

(ii) Alternative source/intake management:

(A) Verification that system has relocated the intake or adopted the intake withdrawal procedure reflected in monitoring results No later than the applicable treatment compliance date in R309-215-15(13).

(iii) Presedimentation: Monthly verification of the following:

(A) Continuous basin operation

(B) Treatment of 100% of the flow

(C) Continuous addition of a coagulant

(D) At least 0.5-log mean reduction of influent turbidity or compliance with alternative Executive Secretary-approved performance criteria.

(E) Monthly reporting within 10 days following the month in which the monitoring was conducted, beginning on the applicable treatment compliance date in R309-215-15(13).

(iv) Two-stage lime softening: Monthly verification of the following:

(A) Chemical addition and hardness precipitation occurred in two separate and sequential softening stages prior to filtration.

(B) Both stages treated 100% of the plant flow.

(C) Monthly reporting within 10 days following the month in which the monitoring was conducted, beginning on the applicable treatment compliance date in R309-215-15(13).

(v) Bank filtration:

(A) Initial demonstration of the following no later than the applicable treatment compliance date in R309-215-15(13).

(I) Unconsolidated, predominantly sandy aquifer

(II) Setback distance of at least 25 ft. (0.5-log credit) or 50 ft. (1.0-log credit).

(B) If monthly average of daily max turbidity is greater than 1 NTU then system must report result and submit an assessment of

the cause. The report is due within 30 days following the month in which the monitoring was conducted, beginning on the applicable treatment compliance date in R309-215-15(13).

(vi) Combined filter performance:

(A) Monthly verification of combined filter effluent (CFE) turbidity levels less than or equal to 0.15 NTU in at least 95 percent of the 4 hour CFE measurements taken each month.

(B) Monthly reporting within 10 days following the month in which the monitoring was conducted, beginning on the applicable treatment compliance date in R309-215-15(13).

(vii) Individual filter performance. Monthly verification of the following:

(A) Individual filter effluent (IFE) turbidity levels less than or equal to 0.15 NTU in at least 95 percent of samples each month in each filter.

(B) No individual filter greater than 0.3 NTU in two consecutive readings 15 minutes apart.

(C) Monthly reporting within 10 days following the month in which the monitoring was conducted, beginning on the applicable treatment compliance date in R309-215-15(13).

(viii) Demonstration of performance.

(A) Results from testing following a Executive Secretary approved protocol no later than the applicable treatment compliance date in R309-215-15(13).

(B) As required by the Executive Secretary, monthly verification of operation within conditions of Executive Secretary approval for demonstration of performance credit within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date in R309-215-15(13).

(ix) Bag filters and cartridge filters.

(A) Demonstration that the following criteria are met no later than the applicable treatment compliance date in R309-215-15(13).

(I) Process meets the definition of bag or cartridge filtration;

(II) Removal efficiency established through challenge testing that meets criteria in this subpart.

(B) Monthly verification that 100% of plant flow was filtered within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date in R309-215-15(13).

(x) Membrane filtration.

(A) Results of verification testing demonstrating the following no later than the applicable treatment compliance date in R309-215-15(13).

(I) Removal efficiency established through challenge testing that meets criteria in this subpart;

(II) Integrity test method and parameters, including resolution, sensitivity, test frequency, control limits, and associated baseline.

(B) Monthly report summarizing the following within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date in R309-215-15(13).

(I) All direct integrity tests above the control limit;

(II) If applicable, any turbidity or alternative Executive Secretary-approved indirect integrity monitoring results triggering direct integrity testing and the corrective action that was taken.

(xi) Second stage filtration: Monthly verification that 100% of flow was filtered through both stages and that first stage was preceded by coagulation step within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date in R309-215-15(13).

(xii) Slow sand filtration (as secondary filter): Monthly verification that both a slow sand filter and a preceding separate stage of filtration treated 100% of flow from surface water sources within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date in R309-215-15(13).

(xiii) Chlorine dioxide: Summary of CT values for each day as described in R309-215-15(19) within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date in R309-215-15(13).

(xiv) Ozone: Summary of CT values for each day as described in R309-215-15(19) within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date in R309-215-15(13).

(xv) UV:

(A) Validation test results demonstrating operating conditions that achieve required UV dose no later than the applicable treatment compliance date in R309-215-15(13).

(B) Monthly report summarizing the percentage of water entering the distribution system that was not treated by UV reactors operating within validated conditions for the required dose as specified in R309-215-15(19) (d) within 10 days following the month in which monitoring was conducted, beginning on the applicable treatment compliance date in R309-215-15(13).

(21) Recordkeeping requirements.

(a) Systems must keep results from the initial round of source water monitoring under R309-215-15(2)(a) and the second round of source water monitoring under R309-215-15(2)(b) until 3 years after bin classification under R309-215-15(11) for filtered systems for the particular round of monitoring.

(b) Systems must keep any notification to the Executive Secretary that they will not conduct source water monitoring due to meeting the criteria of R309-215-15(2)(d) for 3 years.

(c) Systems must keep the results of treatment monitoring associated with microbial toolbox options under R309-215-15(15) through R309-215-15(19) for 3 years.

(22) Requirements for Sanitary Surveys Performed by EPA.

Requirements to respond to significant deficiencies identified in sanitary surveys performed by EPA.

(a) A sanitary survey is an onsite review of the water source (identifying sources of contamination by using results of source water assessments where available), facilities, equipment, operation, maintenance, and monitoring compliance of a PWS to evaluate the adequacy of the PWS, its sources and operations, and the distribution of safe drinking water.

(b) For the purposes of this section, a significant deficiency includes a defect in design, operation, or maintenance, or a failure or malfunction of the sources, treatment, storage, or distribution system that EPA determines to be causing, or has the potential for causing the introduction of contamination into the water delivered to consumers.

(c) For sanitary surveys performed by EPA, systems must respond in writing to significant deficiencies identified in sanitary survey reports no later than 45 days after receipt of the report, indicating how and on what schedule the system will address significant deficiencies noted in the survey.

(d) Systems must correct significant deficiencies identified in sanitary survey reports according to the schedule approved by EPA, or if there is no approved schedule, according to the schedule reported under paragraph (c) of this section if such deficiencies are within the control of the system.

KEY: drinking water, surface water treatment plant monitoring, disinfection monitoring, compliance determinations

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